THE UNIVERSAL ACCOUNTANT,

AND

COMPLETE MERCHANT,

NEW MODELLED.

THE SIXTH EDITION,

With many essential Additions, Alterations, and Improvements;

TWO VOLUMES IN ONE,

BY WILLIAM GORDON, of the Accd. K Glasgow

Late of Glasgow, now of the Mercantile Academy, Edinburgh.

2 Vols in 1.

VOL. I.

QUID MUNUS REIPUBLICÆ MAJUS MELIUSVE AFFERRE POSSUMUS, QUAM SI JUVENTUTEM BENE ERUDIAMUS? CICERO.

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ADVERTISEMENT.

IN this Work, the Author, whose professional Abilities stands unrivalled, has avoided the smallest Innovation on the established Rules of Accountantship, his Object being to diffuse a Taste for accuracy, facility, and dispatch in Calculation, and for arranging and adjusting Accounts of Business with order, regularity, and precision, —In this he has so happily succeeded as to find his Plan universally approved of and adopted,—and the Sale in England and Scotland, where the Merit of the Work has been hitherto known, became so Extensive as to occasion it to run in a short Period through several Editions.

As it is of the utmost Consequence to Youth to learn every thing in a scientific Manner, every Variety relative to the Counting-house is defined, illustrated and explained, so that the different Steps of each Example may be easily traced, and a Plan of Operation made out upon certain Principles, which, without some Knowledge of the Nature of the Transaction, from which the Example is derived, is absolutely impossible. As Skill in Figures depends upon reiterated Practice, the Examples are diversified, that with the greatest Propriety this Book may be introduced, as a text Book into Schools, more especially as it will save the Teacher some Trouble in explaining the different Varieties, as they occur in the several

veral Branches of Trade. In the Article of Exchange ſome new Caſes are added that occur daily in Practice, but have hitherto eſcaped the Obſervation of every Writer on the Subject, with various Methods of expediting Practice in computing them.

In the London Edition ſome Information, merely local, and uſeful only to Merchants there, has been omitted, ſuch as Britiſh Cuſtoms, Licences, Stamps, and ſome other Articles unintereſting to Iriſh Traders, by which Means, they have the Work here, at leſs than half the Price charged for the Edition, encumbered with that unneceſſary Information.

Contents of the First Volume.

PART. I.
The elements of Arithmetic.

PART II.
Of Fractions.
I. Of vulgar Fractions.

II. Of Decimal Fractions.

PART

PART. III.

The application of arithmetic to the business of the merchant, the banker, custom-house, insurance-office, &c.

Varieties in Proportion.

Contents of the Second Volume.

2. Accounts

PART II.

Mercantile accountantship reduced to practice, in various specimens of books, connected and digested as in real trade.

SPECIMEN I.

SPECIMEN II.

ESSAY

ON THE

EDUCATION of a YOUNG GENTLEMAN intended for the COUNTING-HOUSE.

THAT commerce contributes to the prosperity of states, communities, and individuals, in proportion to the wisdom of the laws and regulations upon which it is established, the privileges by which it is encouraged, and the judgment and address wherewith it is conducted, is a truth, which the ingenious writers of all ages have acknowledged, and constant experience has confirmed. Wise institutions and well-concerted bounties for promoting the interest of trade, are the happy effects of good government; and such is the peculiar importance of an extensive and well-regulated commerce to these kingdoms, that it is hoped it will ever be the object of our public care. But the best regulations and the greatest privileges, will signify little, unless they be rendered practical, operative, and useful, by the skill and address of the judicious and industrious merchant. It is he who employs the poor, rewards the ingenious, encourages the industrious, interchanges the produce and manufactures of one country for those of another; binds and links together, in one chain of interest, the universality of the human species; and thus becomes a blessing to mankind, a credit to his country, a source of affluence to all around him, his family, and himself. What extent of knowledge

knowledge, what abilities muſt it require, to fit a man for purpoſes ſo great, ſo valuable and important ? And yet it is certain, that there is not another claſs of men in the Britiſh community, who labour under greater diſadvantages, in point of education, than that of the commercial profeſſion !

A few years are ſpent at the grammar-ſchool, and perhaps a few more at the univerſity ; but ſo little time is allotted for the grammar-ſchool ſtudies, that few, very few, can carry from thence the knowledge or the judgment prerequiſite to univerſity ſtudies ; by which means a number of years is ſpent, and a conſiderable expence laid out, to very little purpoſe. Add to this the low opinion that is generally entertained of the uſe of thoſe ſtudies among men of buſineſs ; which, when it happens to be diſcovered by their children, deſtroys that emulation and ambition to excel, that ought to ſupport them in the elements of learning ; and, in fine, induces them to conſider the whole as a formal drudgery impoſed upon them by cuſtom, which continues only for a certain number of years.

At a certain age, not after certain acquiſitions, a teacher of figures and accounts is applied to ; and, in this caſe, the cheapeſt market is often reckoned the beſt. When the round of this teacher's form is once finiſhed, the ſtudent is then turned over to the counting-houſe ; where, if he is found qualified for nothing higher, which is too often the caſe, he will be employed, during the time of his apprenticeſhip, in copying letters, going meſſages, and waiting on the poſt-office.

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The buſineſs of the counting-houſe is of ſuch importance, and every moment ſo precious to the maſter, that, had he talents for communicating, he hath no time for attending to the inſtruction of an apprentice; who, on the other hand, hath been ſo little accuſtomed to think, that his improvement by ſelf-application will be very inconſiderable. Beſides, his time of life, and conſtant habit of indulgence, render him more ſuſceptible of pleaſurable impreſsions, than of improvement in buſineſs; the more eſpecially as he had been previouſly ſo little prepared to underſtand it. Wherefore it is not at all ſurprizing if many who having no foundation in knowledge to qualify them for the purpoſes of the counting-houſe, profit little from the expence and the time of an apprenticeſhip, and from ſeeing the moſt extenſive buſineſs conducted with all the ſkill and addreſs of the moſt accompliſhed merchant. The conſequence is, no doubt, fatal to numbers; and the public intereſt, as well as private, muſt ſuffer greatly by every inſtance of this nature. It muſt indeed be acknowledged, that there have been, and ſtill are, gentlemen, who, deſtitute of all previous mercantile inſtruction, without money and without friends, by the uncommon ſtrength of natural abilities, ſupported only by their own indefatigable induſtry and application, and perhaps favoured with an extraordinary ſeries of fortunate events, have acquired great eſtates. But ſuch inſtances are rare and rather to be admired than imitated. For we have likewiſe ſeen many go through all the forms mentioned above, ſet out with large capitals, though perhaps without any other mercantile accompliſhment but an adventurous ſpirit, who have ſhone in the commercial world, while their capitals laſted

as meteors do in the natural; but, like them, soon destroyed themselves, and involved in their ruin all such who were unhappy enough to lie within the sphere of their influence*. Commerce is not a game of chance, but a science; in which he who is most skilled bids fairest for success: whereas the man who shoots at random, and leaves the direction to fortune, may go miserably wide of the mark. Parents ought by no means to trust the future prospects of their children in the world to a foundation so weak or uncertain and, indeed, it is not reasonable to expect that the most substantial character in the British community can be formed from an education which is common even to the meanest citizen.

That address in the mercantile profession, hath at all times been both necessary and essential, will, I dare say, be readily allowed, but never, I am certain, was it at any time more requisite than the present. The exigencies of the State, and the support of public credit, have cramped trade with high imposts, and loaded the subject with such contributions, as nothing but well conducted industry can enable them to pay. In the loss of America, the legislature have been effectually convinced, that the strength of a nation does not depend upon foreign acquisitions, and therefore, they have now begun to turn their attention to the more substantial, solid, and permanent advantages, which nature points out in our long neg-

* Novimus novitios quosdam, qui cum se mercaturæ vix dederunt, in magnis mercimoniis se implicantes, rem suam male gessisse; et profecto imperitos mercatores multis captionibus suppositos, multorumque insidiis expositos, experientia videmus. *St. de mercat.*

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lected fisheries, our navigation, agriculture, commerce, and manufactures at home; which alone can encrease our population, multiply the means of our subsistence and employment, prevent emigration, and, in one word, promote national industry, wealth, and prosperity. The national debt, which ought to be a spur to national activity, caution and address, will, no doubt, point out to the legislature, the expediency of reducing the interest of money, so that gentlemen of fortune, to prevent a diminution of their interest, will naturally employ their money in one or other of the branches above-mentioned, to their own emolument and the public advantage. For these, and many other considerations, the knowledge of figures, accounts, and whatever else relates to business in general, becomes highly important, and therefore, it is hoped, a few thoughts on the education of a merchant, will neither be unseasonable, nor unacceptable.

To be able to read the English language with some ease and accuracy, is certainly prerequisite to every other study; and it is with pleasure that we see daily improvements made in this particular. Men of education have not been ashamed of late to take upon themselves the direction of children in reading English, which, but a few years ago, was committed to people of very little knowledge. This is a reformation, which, as it was very much wanted, ought to be particularly encouraged and promoted; although, at the same time, the purposes of it should by no means be extended, especially by those of rank and fortune, beyond proper bounds. It is imagined by some, who have reaped little benefit from three or four years attendance at a grammar school,

ſchool that the new method of teaching Engliſh will anſwer all the purpoſes intended by the ſtudy of dead languages to a man of buſineſs. But this opinion is ill-founded. The ſtudy of the Engliſh language is not carried to a proper extent; and if it were, it would ſtill fall ſhort of the purpoſes of a liberal education. There is no buſineſs whatever that requires a greater correſpondence, or a diction more pointed and conciſe, than that of the merchant; and it would require a ſingular ſtrength of genius to write even correctly in the Engliſh language, unleſs a foundation in the Greek and Latin languages had been previouſly laid. The arts and ſciences, by theſe means, are laid open to us, the moſt ingenious of all ages become our companions and acquaintance, whom we may upon all occaſions with freedom conſult.

The mind muſt be prepared and opened by degrees; and before we know the grammar which reſpects the genius of our own language, we muſt go back to the ſource for the principles of which it is compoſed. The Roman language never arrived at its greateſt perfection till it called in the aſſiſtance of the Greek; and ours would have been void of force and harmony without the aid of both. Beſides, no period of life is ſo apt for proper impreſſions, as the years allotted for the grammar ſchool; and no leſſons furniſh more excellent examples of correct writing and regular living, than what are contained in the claſſics, if they are properly attended to, and judiciouſly improved. It is here where youth are furniſhed with the firſt opportunity of paſſing a proper judgment on what they read, with regard to language, thoughts, reflections, principles and facts, without which

which the knowledge of words would be very insignificant. How apt are young people, unless the foundation of true criticism be properly laid, to admire and imitate the bright more than the solid, the marvellous more than the true, and what is external and adventitious more than personal merit and good sense? And is it not of some importance that youth should be set to rights in particulars so essential? It is here where the taste for writing and living may be in some measure formed, the judgment rectified, the first principles of honour and equity instilled, the love of virtue and abhorrence of vice excited in the mind, provided the grammar-school studies be be properly directed, and carefully pursued.—*Quare ergo liberalibus studiis filios erudimus? non quia virtutem dare possunt, sed quia animum ad accipiendam virtutem præparant. Quemadmodum prima illa, ut antiqui vocabant, literatura, per quam pueris elementa traduntur, non docet liberales artes, sed mox percipiendis locum parat; sic liberales artes non perducunt animum ad virtutem, sed expediunt.*

The study of rhetoric and composition ought by no means to be neglected by a young gentleman intended for the counting room. This will give him an opportunity of reducing to practice, what formerly he had been only taught to relish. It will not only teach, but accustom him to range his thoughts, arguments, and proofs, in a proper order, and to clothe them in that dress which circumstances render most natural. By this means he will not only be able to read the works of the best authors with taste and propriety, but be taught to observe the elegance, justness, force, and delicacy of the turns and expressions, and

still

ſtill more, the truth and ſolidity of the thoughts. Hereby will the connection, diſpoſition, force, and gradation of the different proofs of a diſcourſe be obvious and familiar to him, while at the ſame time he is led by degrees to ſpeak and write with that freedom and elegance, which in any other way will be found very difficult to attain.

But to ſpeak or write well, however neceſſary it may be, is not the only object of mercantile inſtruction. It will be of little conſequence to have the underſtanding improved, if the heart be totally neglected. Man was made by nature for ſociety, but the merchant both by nature and practice; who, if he is not qualified, or not diſpoſed to act his part well, like a bad performer in a concert of muſic, will deſtroy the harmony, and render the whole diſagreeable. Therefore, to tune his mind to virtue and morality, to teach him to blend ſelf-love with benevolence, to moderate his paſſions, and to ſubject his actions to the teſt of reaſon, he muſt have recourſe to philoſophy.

The principles of law and government ought likewiſe to conſtitute a part of the mercantile plan of inſtruction; by which we are taught to whom obedience is due, for what is paid, and in what degree it may be juſtly required: more particularly in Britain, where we profeſs to obey the Prince according to the laws; and indeed we ourſelves are ſecondary legiſlators, ſince we give conſent, by repreſentatives, to all the laws by which we are bound, and have a right to petition the great council of the nation, when we find they are deliberating upon any act which we think will be detrimental to the intereſts of the community,

community with respect to commerce, or any other privilege whatever.

As it is not impossible but our young merchant may one day be called to represent his fellow-citizens in the British Senate, elocution is a study that ought by no means to be overlooked. Eloquence has been defined the ornament of wisdom, and the imperial diadem of science; for however great a man's attainments may be in other respects, they will signify little, in a public capacity, if the gift of speech be wanting, especially in a country where we cannot mix in society, without finding some occasion to deliver our sentiments on subjects of art, commerce, or policy. In public assemblies, a good speaker attracts the attention, and gains the assent of his auditory; and in the British Parliament it has been often found, that eloquence has had astonishing effects.

When a young man hath been thus accustomed to application, reason, and reflection; when his ideas and modes of expression have been thus multiplied, polished and refined; when his taste hath been formed, and his judgment confirmed; the study of those sciences which more immediately respect the counting-house, will become easy and agreeable: but it is necessary his teachers should keep up the same spirit and dignity in their instructions with which his earlier studies were animated, otherwise the design of the whole may be in danger of being frustrated.

The first care of a scholar, who is put under the tuition of a new master, is, to observe, to study, and to sound him; and it generally holds, that the proficiency of the one, and the authority of the other, are both in proportion to the judgment which the scholar forms of his master's

prudence and abililies; for which reaſon, parents cannot be too ſtrict in their enquiries concerning the temper, qualifications, and character of a maſter, before they truſt him with ſo important a charge, as the happineſs and proſperity of their children during the whole courſe of their lives.

Writing, the elements of arithmetic, and the French language, ſhould, I think, be the firſt objects of inſtruction, when a young man is ſent to an academy, to be prepared for the counting-houſe; and theſe ought to be taught at particular hours on the ſame day. It is neceſſary that a young man commence the ſtudy of the French language early, that he may be able not only to tranſlate, but ſpeak and write the language with eaſe, before he enters the counting-houſe.

Writing is a prerequiſite to every other ſtep; and therefore no time ſhould be loſt in making him as ſoon and as much maſter of the pen as poſſible. To teach arithmetic well, which is another leading ſtep, requires more ſkill and knowledge than perhaps is attended to. It is of all the ſciences, the moſt neceſſary to the mercantile profeſſion; and it is not a little ſurprizing that it ſhould by ſo many be ſo ſhamefully neglected. How many of thoſe who pretend to teach arithmetic have ever been at pains to qualify themſelves for the office, or even to enable them to depart from their own beaten track? No man ſhould think himſelf qualified for this office, until he had made buſineſs, and the method of conducting it, as well as every mode of calculation that reſpects it, a particular ſtudy. For before arithmetic is applied to computations in buſineſs, the powers, properties, and relations

relations of numbers ſhould be particularly taught and explained. Every rule ſhould be demonſtrated, exemplified, aud illuſtrated in an eaſy and intelligible manner; and the examples ſo multiplied and diverſified, that the learner may be thoroughly grounded, and have a reaſon always ready for what he doth; all the various compendiums which ſerve to abbreviate operations ſhould be diſtinctly ſhewn and demonſtrated, that facility and diſpatch may be equally familiar. When he hath thus become maſter of the capital rules in vulgar and decimal arithmetic, involution and evolution, he ought then to be introduced to geometry and algebra, which of all his ſtudies coutribute moſt to invigorate the mind, to free it from prejudice, credulity, and ſuperſtition, and to accuſtom it to attention, and to cloſe and demonſtrative reaſoning. In the courſe of theſe ſtudies, be ſhould be taught a new demonſtration of all his arithmetical rules; and the whole theory ought to be reduced to practice, in the menſuration of ſurfaces and ſolids, heights and diſtances, and in conſtructing the inſtruments he hath occaſion to uſe.— When practice is thus joined to demonſtration, the ſtudy of the ſciences becomes eaſy, entertaining, and inſtructive: whereas, were a young man to hear nothing elſe but demonſtration, he would ſoon be wearied of that kind of ſtudy. and conſider it as very dry and inſipid: but when he ſees the uſe of mathematics, in laying down plans and maps of countries, ſelling land by meaſure, aſcertaining the price of labour, and determining the quantity of liquors for a regulation of their price and duty, he muſt be convinced of their influence, and admire theit excellency. To complete his ma-

tical courſe, he ſhould be made acquainted with navigation and geography. The firſt, after ſuch a general acquaintance with the mathematics, will require no great ſtudy; but to the laſt more time and reading will be abſolutely neceſſary. The ſolution of a few problems on the globe, and three or four ſtudied harangues, will come far ſhort of anſwering the deſign. A teacher who conſiders the extent of geography neceſſary to a merchant, muſt ſee that the knowledge of the globes is no more than the elements of what he ſhould be inſtructed in. He muſt be made acquainted with the uſe of maps, the ſituation, extent, produce, manufactures, commerce, ports, politics, and regulations, with reſpect to trade, of all the nations in the world, not only by public lectures, but by private reading and converſation. This will not be the work of a few days or a month; and thoſe who allot no more time for geography, know very little of the ſubject. Half an hour every day for ſix months together, ſpent in private inſtruction and examination, will perhaps be found little enough for a ſtudy ſo extenſive and important.

When the foundation is thus properly laid by ſuch a mathematical courſe as I have been deſcribing, communicated in that demonſtrative and practical manner, which will join ſcience with judgment, and conviction with experience; the counting-houſe muſt begin to open, and the *arcana mercatorum* be expoſed to view. Arithmetic muſt again be reſumed, and the former theory reduced to practice, in all the caſes which can occur to the merchant, the banker, the cuſtomhouſe, and inſurance office; to which every obſervation

observation ought to be joined, which will serve to illustrate the use of the different examples in that particular branch of business to which they may be applicable. A proper course of reading at this period, which might be wonderfully improved by the conversation of a good master upon the subjects of insurance, factorage, exchange, and such other branches of business, will be of singular use, not only to form the mind to business, but, when he comes to act for himself, to prevent many tedious and expensive pleas, which an ignorance in the practical arts of negociating them is frequently apt to create.

To this course of reading, an epistolary correspondence among the students themselves might, with great propriety, be added; as it would give them the practice of folding letters in a quick and dexterous manner, accustom them to digest well whatever they read, and improve their diction, under the correction of an accurate master, to that clear, pointed, and concise manner of writing which ought peculiarly to distinguish a merchant. Fictitious differences among merchants might likewise be submitted to their judgment, sometimes to two in the way of arbitration, and again to a jury of fifteen; whilst one would assume the character of the plaintiff, and another that of the defendant, and each give in such memorials or representations, according to the nature of the facts condescended on, as he thinks most proper to support the cause, the patronage of which had been assigned him. Thus will youth be accustomed to think, write and act like men before they come upon the real stage of action; and their appearance in real life will have nothing of the aukward and stupid manner which is

generally

generally obſerved in young men for ſome time after they enter the counting-houſe.

When a young man hath thus attained to a proper accuracy and diſpatch in figuring, and ſome idea of the different branches of buſineſs with which every kind of computation is connected; it is time then to introduce the young merchant to book-keeping, which is the laſt, but not the leaſt important branch of education previous to the counting-houſe. It is become a proverb in Holland, That the man who fails did not underſtand accounts. And indeed, however much a merchant who is concerned in an extenſive trade, may be employed in matters of a higher nature, and upon that account be neceſſitated to make uſe of the aſsiſtance of others in keeping his books, he ought certainly to be capable of keeping them himſelf; otherwiſe he never can be a judge, whether juſtice is done to him in that eſſential particular or not; neither can he have that idea of his own buſineſs, which is indiſpenſibly neceſſary to the proſperity of his trade.

This happy method of arranging and adjuſting a merchant's tranſactions, muſt, like other ſciences, be communicated in a rational and demonſtrative manner, and not mechanically by rules depending on the memory only. The principles upon which the ſcience is founded, muſt likewiſe be reduced to practice by proper examples in foreign and domeſtic tranſactions; ſuch as buying, ſelling, importing, and exporting for proper, company, and commiſsion account; drawing on, remitting to; freighting and hiring out veſſels for different parts of the world, making inſurance and underwriting; and the various other articles that may

may be supposed to diversify the business of the practical counting-house. The nature of all these transactions, and the manner of negociating them, ought to be particularly explained as they occur; the forms of invoices and bills of sales, together with the nature of all intermediate accounts which may be made use of to answer particular purposes, ought to be laid open; and the forms of all such writs as may be supposed to have been connected with the transactions in the waste-book, should be rendered so familiar, that the young merchant may be able to make them out at once without the assistance of copies.

As the following work is intended to be a complete course of mercantile computations and accountantship, to say more on the method of communicating them would be unnecessary. Only I would beg leave to hint, that there are many things, the knowledge of which is better inculcated by public lectures, private reading and conversation, than in the ordinary method of teaching, when, perhaps, there may be two or more classics to direct. The rationale of commerce in general; the trade of the place where we live; the laws, customs, and usages relative to the business of a merchant; the penalties to which he is liable, and the privileges to which he is entitled; the duties, imposts, and other charges laid upon the British produce in other countries, with all the known maxims that relate to the prosperity of trade; will open a wide field for improvement in matters of real use to the master as well as the student.

When the education of a young gentleman is thus conducted, from his earliest years, in a manner caculated to engage his mind in the love of

useful

useful knowledge; to improve his understanding; to form his taste, and ripen his judgment; to fix him in the habit of thinking, steadiness, and attention; to promote his address and penetration, and raise his ambition to excel in his particular province; will not the transition to the counting-house be extremely easy and agreeable? His knowledge will be so particular, and his morals so secured, that he will be proof against the arts of the deceitful, the snares of the disingenuous, and the temptations of the wicked. He will, in a short time, be so expert in every part of the business of the practical counting-house, and be able to form such judgment of every thing he sees transacted, that when he comes to act for himself, every advantage in trade will lie open to him: his knowledge, skill, and address, will carry him through all obstacles to his advancement; his talents will supply the place of a large capital; and the beaten track of business becomes less advantageous, by being in too many hands, he will strike out new paths for himself, and thus bring a balance of wealth, not only to himself, but to the community with which he is connected, by branches of trade unknown before.

How few are there, even among parents, who, perhaps have felt the loss of a proper education in their own practice, that consider the extent of knowledge requisite to make a young gentleman appear with dignity in the commercial life? and how few are there among those who profess to qualify young gentlemen for the counting-house, that have knowledge in any degree proportionable to their credit? The reason is obvious: In every other article of expence, considered as communities or individuals, we are generally

rally profuse; but in that which relates to education, we are shamefully narrow. This false parsimony, this mistaken frugality, prevents men of genius and education from appearing as teachers, because their talents will turn out to much more account, in almost any other profession whatever; and if circumstances should have rendered it necessary for a man of some abilities to turn his mind this way, he is obliged to divide his studies among so many different sciences, and his time among so many different classes, to secure to himself a bare subsistence, that he hath neither the leisure, the means, nor the opportunity of that reading or conversation which is absolutely necessary to his practice, in instructing youth in the most difficult and important branch of literature. And if this is the case with the ablest teachers, what can be expected of those who become teachers because they were really qualified for nothing else. For the instruction of youth in every other science, we have not only excellent institutions, but eminent masters, whose abilities are inquired into and approved of, before they are admitted to the important trust: but in this case, great pretensions, which are generally taken upon the teacher's word, and low prices for the articles of education in his scheme, are credentials sufficient to procure him business, though neither the teacher nor the students reap much advantage from it.

The art of managing and forming the mind is perhaps of all sciences the most intricate and extraordinary, and certainly the most important; and therefore, that it may be sufficiently studied, ought to be properly rewarded. It is no doubt the business of magistrates to in-

terest themselves in the education of youth, since they are the nursery of the State, by which it is renewed and perpetuated, and upon whom the national prosperity, as well as the national existence, depends. If part of the public revenues were employed in erecting academies for training up youth to business, especially in trading cities, where every master should have a salary proportioned to the difficulty of his department; if the most intelligent merchants were appointed as superintendants of these academies, who would take care that none be admitted as teachers, who were not properly qualified for the charge, nor any as students, whose proficiency in the languages, rhetoric, and philosophy had not been previously inquired into, nor any suffered to prosecute the studies prerequisite to the counting-house, whose genius were not in some measure turned to act with dignity in the mercantile profession; if these gentlemen would enquire often into the morals and proficiency of the students, converse frequently with the masters on the subject of trade, and admit the students according to their seniority in letters to such conversations, and, in short, take every other method of encouraging both masters and students to industry and attention, that they might go through the tedious, the difficult task with alacrity and spirit; if parents, at the same time, would set that value upon education which they sometimes do upon trifles, and be but as careful in having the minds of their children adorned with virtue and good sense, as they are in setting off every thing which relates to their bodies, we might then expect to see a reformation. Were this to be the case, our youth would be long acquainted with the

arts

arts of gaining before they would learn how to ſpend money, and they would not be grown old in debauchery and riot, before they were initiated into buſineſs. Were this to be the caſe we would ſoon ſee a ſpirit of induſtry, knowledge, humanity and good ſenſe diffuſe itſelf among all ranks and denominations, whilſt idleneſs and folly, with all their miſchievous train, would be baniſhed the ſtreets. In one word, our teachers would be men of underſtanding, our young men would be ſenators, and our "merchants would "be Princes."

THE
UNIVERSAL ACCOUNTANT.

PART I.

THE ELEMENTS OF ARITHMETIC.

INTRODUCTION.

ARITHMETIC is the art of reckoning by numbers, which, from the various combinations of these ten Arabian characters, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, teacheth to calculate with expedition, exactness and ease.

To render operations more short and expressive, with great propriety have been introduced the following

CHARACTERS.

The sign		signifies		read
	$+$		Addition,	More.
	$-$		Subtraction,	Less.
	$\times$		Multiplication	Into
	$\div$		Division,	By.
	$=$		Equality,	Equal to
	$: \; :: \; :$		Proportion,	As to. So is.
	$\sqsupset$		Majority,	Greater than.
	$\sqsubset$		Minority,	Less than.
	$\sqrt[2]{\ }$		Extraction of,	Square-root.
	$\sqrt[3]{\ }$		Extraction of,	Cube-root.

It is not my present purpose, nor would it be material, to trace this useful art back to its original, or carry it through all the different steps of its improvement. The Lombards, no doubt, imported it into Britain; and, for its after improvements, we have been equally obliged to the productions of the ingenious, and practice of the industrious.

CHAP. I. NUMERATION.

NUMERATION teacheth to read or write any number known, or propoſed.

RULE I.

To read any number, divide it by commas into claſſes of three characters each, beginning at the right-hand; over the right-hand figure of the third claſs, make a point; over that of the fifth, two points; over that of the ſeventh, three points, &c. The number to the left-hand of the firſt comma, expreſs by thouſands; that which hath over it the firſt point, by millions; that which hath over it the ſecond; by billions; that which hath over it the third, by trillions. &c. The left-hand character of each claſs is expreſſed by hundreds, the middle one by tens and the right-hand one by units.

RULE II.

To write down any propoſed number, reverſe the former rule; and, if any intermediate place is wanting, fill it up with the cipher, (0). Upon theſe principles is effected the following table.

NUMERATION-TABLE.

0	1	Units.
0	2	Tens.
0	3	Hundreds.
0	4	Thouſands.
0	5	Tens of Thouſands.
1	6	Hundreds of thouſands.
0	7	Millions.
0	8	Tens of Millions.
0	9	Hundreds of Millions.
0	1	Thouſands of Millions.
0	2	Tens of Thouſ. of Millions.
1	3	Hundreds of Thouſ. of Mill.
0	4	Billions.
0	5	Tens of Billions.
0	6	Hundreds of Billions
0	7	Thouſands of Billions.
0	8	Tens of Thouſ. of Billions
1	9	Hundreds of Thouſ. of Bill.
1	1	Trillions.

OBSER-

OBSERVATION.

It is obvious from the table, that all numbers increase in a decuple proportion; and, consequently, that, in a series of numbers, every figure hath a local, as well as simple value: hence ciphers, though they have no simple value, when annexed to significant figures, remove those figures so many steps from the units place, and increase their value accordingly.

CHAP. II. ADDITION of INTEGERS.

ADDITION teacheth to find a sum which shall be equal to several homogeneous ones given.

RULE.

Place the numbers, each of the same local value, under one another successively; then, beginning with the lowest, or units place, find the sum thereof by collecting them all together, and of that sum, or total write down under the column of units what belongs to that name, and carry the number of tens to be added with the next column, being the denomination to which, in the very nature of numbers, it belongs: of the sum or total of the columns of tens, write likewise down, under that column, the units place, whose value will be tens, and carry the tens to be added with their homogeneous column, which is hundreds. Proceed thus through the whole, and take down the sum of the last column all together, there being no other to which it can be carried.

EXAMPLES.

(1.)	(2.)	(3.)	(4.)
75468	74367	478561	59374
37546	43243	37456	38
18764	67548	5937	473
34653	32764	5478	89
21687	13487	5684	9
85464	54728		45
273582	286137		

Illustration of the first example,

3+7=10+14+4=18+6=24+8=32; of which total, 2 belongs to the units column, and is accordingly taken down there; the 3 in its local value is 30, or three tens; therefore 3+6+8+5+6+4+6=38 tens, or 380; of which total, 8 belongs to the place of tens, where it is taken down, and the 3, or 300, carried to be added with the column of hundreds; thus, 3+4+6+6+7+5+4=35, or 3500; therefore 5 falls to be noted down in the place of hundreds, whilst the 3 remains to be added with the column of thousands, to which it belongs; thus, 3+5+1+4+8+7+5=33, or according to its local value, 33,000 of which total, the 3 to the right-hand is taken down in the place of thousands, and the other 3 carried to the column of tens of thousands; thus, 3+8+2+3+1+3+7=27, or, in its local value, 270,000; of which sum the 7 is taken down in its homogeneous column, and the 2 in the place of hundreds of thousands, to which it naturally belongs. The whole taken together becomes 273, 582.

OBSERVATIONS.

1. Had the units place of any of the sums of the columns been 0, it is plain that 0 would have been taken down in that place.

2. Had any of the sums consisted but of one place only, there would have been nothing to carry to the next columns.

3 The reason of this manner of operation is sufficiently demonstrated in the illustration, being a plain deduction from the nature of numbers; and, as all the parts of any thing whatever must be equal to the whole, the sum or total, thus found with sufficient accuracy, must be equal to the several given numbers taken together.

4. Operations in this rule may be proved by dividing the numbers in two or three different classes, finding the sums of these severally, and collecting their totals again into one; which, if the operations were right, will agree with that total which was taken at once. Men of business prove their summations by adding first upwards and then downwards.

EXAMPLES.

7458		54856	
5978		34785	
4567		67857	
	18003	34158	
8452		41213	
3456			
3978	15886	242869	Upwards.
		242869	Downwards.
33889 =	33889		

5. Expedition, as well as exactneſs in calculating, depends much upon improving the memory; and, as addition occurs more frequently in buſineſs than almoſt any other rule in arithmetic, both diſpatch and accuracy are abſolutely neceſſary: wherefore, when one is ſufficiently accuſtomed to add the figures one by one, he ſhould be gradually led to take them two by two, three by three, by either or more, as appears convenient; which will not only promote diſpatch, but be leſs liable to error. Thus for inſtance, the firſt four figures in the units place of the firſt example, to one who hath been ever ſo little accuſtomed to addition, will at once preſent the ſum of 18, and the other two figures 14=32, &c.

Chap. III. SUBTRACTION of Integers.

Subtraction finds the difference, called the *remainder* betwixt a leſſer number, called the *ſubtrahend*, and greater, called the *minuend*, and is the converſe of addition.

RULE.

Place the number, each of the ſame local value, under one another reſpectively, the ſubtrahend in a line directly under the minuend. Then, beginning at the units place, if the figures in the ſubtrahend be equal to that correſponding in the minuend, write down a cipher for the difference; if leſs, take down the figure which repreſents the difference; but, if greater, increaſe it by 10, and then take down the difference; remembering at the ſame time, that however oft the minuend muſt be ſo increaſed, the next place

place in the subtrahend must be likewise increased by unity. Proceed thus till the whole remainder is taken down and compleated.

EXAMPLES in INTEGERS.

	(1.)	(2.)	(3.)	(4.)
Minuend,	8467548	546317	47856478	5741563
Subtrahend,	3254138	257168	39764789	3194585
Remainder,	5213410	289149		

Illustration of the second example.

Beginning with the units place; because 8 is more than 7. increase 7 with 10, and 17 becomes the minuend; therefore. $17-8=9$, or $19+7-8=9$; because the minuend was thus increased by 10, the next figure in the subtrahend must be increased by 1, which in effect is 10, and then it will be $6+1=7$; but still the corresponding figure in the minuend is less, and therefore the same increase must be repeated, and then it will be $10+1-7=4$. In the same manner, and for the same reason, the next figure in the subtrahend must be increased by 1, and it will become 2; the correspondent figure to which in the minuend is 3, and their difference, without any increase is 1; which is noted down, and nothing carried to the next figure in the subtrahend, &c.

OBSERVATIONS.

1. When all the figures in the minuend are greater than, or some of them equal to their correspondents in the subtrahend, it will be obvious, that the difference of the figures put down as correspondents, must when taken as one sum, be the difference or remainder required; for as all the parts of any number taken together are equal to the whole, so the difference of all the parts of any two numbers make together the difference of the wholes.

2. When any figure in the subtrahend is greater than its correspondent one in the minuend, the latter, before subtraction, is increased by 10; and, for that reason, the next subtrahend figure is increased by 1: because from the nature of numbers, 10 in any place is equal to 1, in the next place to the left; therefore an equal number increase both factors and

and the difference must accordingly be equal; for the same difference will always exist betwixt 9 and 17, as betwixt 19 and 27, or betwixt 29 and 37, *ad infinitum*.

3. If one number is to be subtracted from several, several from one, or several from several, it is plain, that they must be reduced to two factors before subtraction, by addition.

4. The accuracy of operation in this rule may always be proved by adding the remainder to the subtrahend, whose sum, when the operation is right, will be equal to the minuend; because the subtrahend and remainder are the parts of the minuend, which is considered as the whole.

CHAP: IV. MULTIPLICATION of INTEGERS.

MULTIPLICATION serveth instead of many additions; and from two numbers given, called the *multiplier* and *multiplicand*, findeth a third, called the *product*, which shall repeat the multiplicand so oft as the multiplier contains unity. For the more expeditious management of this rule, it will be necessary to commit to memory the following

TABLE OF MULTIPLICATION.

2× 2= 4	3× 3= 9	4× 5=20	5× 8=40	6×12=72	8×12= 96
2× 3= 6	3× 4=12	4× 6=24	5× 9=45	7× 7=49	9× 9= 81
2× 4= 8	3× 5=15	4× 7=28	5×10=50	7× 8=56	9×10= 90
2× 5=10	3× 6=18	4× 8=32	5×11=55	7× 9=63	9×11= 99
2× 6=12	3× 7=21	4× 9=36	5×12=60	7×10=70	9×12=108
2× 7=14	3× 8=24	4×10=40	6× 6=36	7×11=77	10×10=100
2× 8=16	3× 9=27	4×11=44	6× 7=42	7×12=84	10×11=110
2× 9=18	3×10=30	4×12=48	6× 8=48	8× 8=64	10×12=120
2×10=20	3×11=33	5× 5=25	6× 9=54	8× 9=72	11×11=121
2×11=22	3×12=36	5× 6=30	6×10=60	8×10=80	11×12=132
2×12=24	4× 4=16	5× 7=35	6×11=66	8×11=88	12×12=144

RULE.

When the multiplier consists of any number within the bounds of the table, the product is found at once, by multiplying every figure or place on the multiplicand into the multiplier, one after another, beginning with the units place; and the several products

are

are wrote down as the ſeveral ſums in addition; but, when the multiplier exceeds the bounds of the table, the product of every particular digit muſt be taken by itſelf, the firſt figure of every particular product placed directly below its reſpective multiplier, to anſwer the local value thereof, and the ſum of theſe ſeveral products will be the product required.

EXAMPLES.

(1.)		(2.)	(3.)
8754675543	Multiplicand.	437546754	47845678978
8	Multiplier.	12	11
7003740344	Product.	5250561048	

Illuſtration of the firſt example.

Beginning with the units place, by the table, $8\times3=24$, of which product 4 is taken down in its own place: then $8\times4=32+2$, in the ſecond place of the laſt product, $=34$, in its local value$=340$, whereof 4 falls to be noted down in its own place, *viz* the place of tens: again, $8\times5=40+3=43$; 3 is taken down in its own place, and 4 is reſerved to be carried to the product of the ſucceeding figure, then $8\times7+4=60$; here 0 is noted: $8\times6+6=54$, 4 is noted: $8\times4+5=37$, note 7; $8\times5+3=43$, note 3; $8\times7+4=60$, note 0; $8\times8+6=70$, which is taken down all together, becauſe there is no new product to which the figure in the higheſt place could be carried.

Example (4.)

(4.)		(5.)	(6.)	
745678		549356	67540573	
345		678	30405	
3728390	3 X 1 (3 above, 3 below)		337702865	3 X 1 (3 above, 3 below)
2982712			270162292	
2237034			202621719	
257258910			2053571122065	

OBSERVATIONS.

1. When the multiplier conſiſts of any number within the bounds of the table, the reaſon of the operation will be plain

plain from what hath been ſaid in addition, ſince multiplication is only a repetition of that rule, ſo oft as the multiplier contains unity; to be ſatisfied of which any one may make the experiment at pleaſure, by finding the ſum of any multiplicand repeated as oft as the multiplier contains unity.

2. When the multiplier exceeds the bounds of the tables the products are taken partially, and the ſum of theſe products muſt as certainly be the whole product, as it is true that the whole is equal to all its parts taken together. The reaſon of placing the firſt figure of every particular multiplier's product below its reſpective multiplying figure, will appear from this conſideration, that as each figure hath a ſimple and local value, both theſe values muſt be retained in the product: for inſtance, in the multiplier of the 4th example, 4, from the place in which it ſtands, is really 40, and conſequently the firſt figure of its product is not 2, but 20; for which reaſon it muſt ſtand in the place of tens. For the ſame reaſon, 4, in the multiplier of the 6th example, is 400; and therefore 2, the firſt figure of its product, is 200, and for that reaſon ſtands in the place of hundreds.

3. Operations in this rule may be proved, by ſhifting the factors, the reaſon of which is obvious; but more expeditiouſly by caſting out the 9s. For an example, take an illuſtration of the proof of example 4.

* $7+4=11$. exceeding 9 by 2, and $2+5+6=13$. exceſs, $4+7=11$, exceſs $2+8=10$, exceſs 1, which is noted on the right ſide of the croſs. The ſame is done by the multiplier thus $3+4+5=12$, exceſs 3, noted on the left ſide of the croſs then $3\times1=3$, noted, as it does not exceed 9, on the top of the croſs. If it had been 9, 0 would have been noted; if more than 9 or 9s, the exceſs. After the ſame manner are the 9s caſt out of the ſum of the products, and the laſt exceſs is found to be 3, which is ſet at the bottom of the croſs, and proves the operation to be right, being equal to the figure at the top. For becauſe in what ever place any figure ſtands, taken in its ſimple value, according to the place in which it ſtands, it will be equal to what remains, after all the 9s continued in its value are taken away; it follows that the ſum of all the figures of which any number conſiſts, conſidered ſimply as ſo many units, is equal to the remainder, after all the 9s are taken out of that number, which can be found in the real value of each figure of which it conſiſts. Hence, if this ſum be leſs than 9, it is equal to what remains when all the 9s poſſible are taken out of that number. But if this ſum is

is equal to, or exceeds 9, the remainder, when the 9s are taken out, will be equal to what remains when the 9s are taken out of the given number; because the number of 9s in any number must be equal to the number of 9s which is contained in the several products, and in the sum of the excess 9s in those parts.

More examples to facilitate practice.

347859372×345=119011583340
78064375×6789=529979047875
87543897×50608=4430421539376
67430709×90065=6073146806085
84357259×81075=
6749308×72093=

CONTRACTIONS in MULTIPLICATION.

1. When there are ciphers on the right of either, or both factors, they may be neglected in the operation, but annexed to the sum of the products.

EXAMPLES.

(1.)

```
 7415678000
     123000
 ----------
   22247034
  88988136
 ---------------
 912128394000000
```

```
    3
 2  X  6
    3
```

(2.)

```
   53400
    560
 -------
   3204
  2670
 ---------
 299040000
```

```
    6
 2  X  3
    6
```

Hence, to multiply by 1 and any number of ciphers annexed to it, is only to annex those ciphers to the multiplicand.

2. When unity is in the place of tens of the multiplier, the product may be found in one line, by adding the product of that place in the multiplication; and the same method may be extended by practice, to 2 or 3 in the place of tens.

EXAM-

EXAMPLES.

(1.)

874675432
15
―――――――――
13120131480

X: top 6, left 6, right 1, bottom 6

(2.)

84670000
23
―――――――――
1947410000

X: top 8, left 5, right 7, bottom 8

3. It will be found convenient, in applicate queſtions, to work by the component parts of the multiplier, which, for any ſmall number, will be found in the table: but if the multiplier be ſuch a number, for which no component parts can be exactly found, the neareſt component parts muſt be taken, and the multiplicand being added ſo often to the laſt product, as the product of the component parts come ſhort of the given multiplier, or ſo often ſubtracted from it, as the product of the parts exceeds the given multiplier, the ſum in the one caſe, and remainder in the other, will give the true product.

EXAMPLES.

(1.)

54537543 by 56
7
―――――――――
381762801
8
―――――――――
3054102408

X: top 0, left 6, right 0, bottom 0

(2.)

3741500 by 74
8
―――――――――
299320
9
―――――――――
269388000 Product of 72
7483000 Product of 2
―――――――――
276871000 74

X: top 4, left 2, right 2, bottom 4

The proof is taken by caſting the nines out of the given multiplier, and not the artificial ones.

4. If the given multiplier is a number exceeding the bounds of the table, multiply by as many tens as the multiplier conſiſts of places ſave one, the laſt product by the firſt figure on the left-hand, the next in order by the ſucceeding place, &c. the ſum of the products of theſe places gives that required.

 EXAM-

EXAMPLES.

(1.)

8×436843246 by 578

10

7×4368432460

10

43684324600

5

218421623000=the product of 500.

30579027220=the product of 70.

3494745968=the product of 8.

252495396188=the product of 578.

(2.)

74563000 by 6002

10

745630

10

7456300

10

74563000

6

447378000000

149126000

447527126000

5. If the multiplier be any number near 100, 1000, 10000, &c. increase the multiplicand by as many ciphers as there are figures in the multiplier, and subtract the multiplicand from itself thus increased as often as the multiplier wants units of that by which the multiplicand was increased.

EXAMPLES.

(1.) Multiply 8754687 by 999.

999 is 1 short of 1000

Therefore 8754687000

8754687

8745932313

(2.) 4378 into 9998.

43780000

8756=2×4378.

43771244=9998×4378

6. When the multiplier can be parted into periods which are multiples of one another, the operation may be contracted in the following manner.

EXAMPLES.

(1.)

5697487

96488

45579896=8×5697487

273479376 =6×45579896, because 60×8=480

546958752 =2×273479376, bcause 200×480=96000

549739125656=5697487×96488

Note,

Note. One number is said to be the multiple of another, when it contains it a certain number of times without any remainder.

Or, in a reversed order, thus:

(2.) 5742135 into 52575
52575

28710675 = 50000 × 5742135 for 50000
143553375 = 500 × 28710675 for 2500
430660125 = 3 × 143553375 for 75

301892747625 = 5742135 × 52575

7. If the multiplier be a repetend of the same figure, multiply by one of repeating figures; and the figures of that product added, as if they had been wrote down in as many products as the multiplier repeated the same figure, give the product required.

EXAMPLES.

(1.)
547856789
22222

1095713578

12174473565158

(2.)
54018
3333

162054

180041994

8. When the repeating figure is a high digit, collect the product of as many ones as there are digits in the multiplier, from the multiplicand, according to the rule in the last contraction, which product being multiplied into the repetend, will give the true product.

Example. 784325634 into 7777777.

871472839519374 products collected for 1111111.
7

6100309876635618 product of 7777777

There

There is another contraction for finding the product of any series of repeating figures, more elegant than any of the preceding, but it will come in more properly in the next chapter.

CHAP. V. DIVISION of WHOLE NUMBERS.

DIVISION findeth how oft one number is contained in another, and is a compendious method of subtraction, in the same sense that multiplication is a compendious method of addition.

RULE.

Place the dividing number, called the *divisor*, on the left of the dividend, or number to be divided, and on the right of the dividend place the quotient, as in the examples following. The factors being thus placed, point off so many places from the right of the dividend, as are equal to, or not exceeding the product of the divisor, into any one of the 9 digits, and this is called a *dividual*: in which, having considered how often the divisor is contained, note the number of times in the quotient, then subtract the product of that quotient figure, after it is multiplied into the divisor, from the dividual, and to the remainder affix the next place in the dividend for a new dividual, with which proceed as before; and if the divisor is not once contained in any dividual, increase the quotient with a cipher, before any new place is taken down to the right of the dividual; if any thing remains after all the places are taken down from the dividend, it is called the *remainder*, which, with the divisor, expresseth some parts of unity, the number whereof is ascertained by the remainder, and the quality by the divisor.

EXAM-

EXAMPLES.

```
        (1.)                              (2.)
Divisor. Dividend. Quotient.
   12.) 475678 (39639 10/12        15) 7846735 (523115 10/15
        36                             75
        ---                            --
        115                             34
        108                             30
        ---                             --
          76                             46
          72                             45
          --                             --
           47                             17
           36                             15
           --                             --
           118                             23
           108                             15
           ---                             --
           (10) Remainder.                  85
                                            75
                                            --
                                           (10)
```

Illustration of Example first.

The divisor 12 is found in the first dividual 47, three times, which is noted in the quotient, and being multiplied into the divisor, presents a product of 36, which is brought down below its own dividual 47; and subtracted therefrom by which means we discover a remainder of 11: to this remainder the next figure in the dividend being affixed, we are presented with a new dividual of 115, which contains the devisor 9 times; consequently 9 is noted in the quotient, and multiplied into the divisor; the product 108, being subtracted from its dividual 155, leaves a remainder of 7, to be increased by the next figure in the dividend, *viz.* 6; with which, and the remaining part of the dividend, we proceed as before, and at last there remains 10; which being taken up with the divisor, and noted after the integral part of the quotient, expresses ten twelfth parts of one.

OBSER-

OBSERVATIONS.

Since by the above method of division, the dividend is taken into as many dividuals as possible, and the quotient taken out of the first dividual as near as possible, the defect made the foundation of the succeeding dividual; and this operation being repeated so oft as there were places in the dividend to bring down, or quotient figures to note, it will be plain; if there hath been no error in the operation, that all the parts of the dividend have been added, and the number of times the divisor is contained in those parts hath been separately found: and since all the parts taken together are equal to the whole, it must follow, that however often the divisor is contained in those parts which constitute the dividend, so often must the divisor be contained in the whole dividend.

2. The best proof of operations in this rule is made by multiplying the quotient into the divisor whose product added to the remainder, if any, must be exactly equal to the dividend.

A proof less certain, but much more expeditious, may be made by casting out the nines, as in multiplication, considering the integral part of the quotient as a multiplicand, the divisor as a multiplier, and the dividend—the remainder as a product. The proof by the nines, in either case, can only be applied to integers or decimals; so that, upon the whole the best and most general proof of multiplication is division; and, *vice versa*, of division, multiplication.

Example (3.)

375) 5478989 ($14610\frac{239}{375}$

375	375
1728	73289
1500	102270
	43830
2289	
2250	5478989 Proof by Multiplication.
398	
375	
239	

(4.)

25476) 88350768 (3468

76428	0
119227	3 X 6
101904	0
173236	
152856	Proof by casting out the nines.
203808	
203808	
0	

345)119011583340(347859372
6789)5299790478 75(78064375
50608)4430421539376(87543897
90065)6073146806085(67430709
64079)8540375689(
97067)4976832758(

OBSERVATIONS.

1. If any significant figure by itself, or with any number of ciphers annexed, be divided by 9, the remainder will be equal to the significant figures taken in their simple value. For divide 7 by 9, and the quotient will be 0 and remainder 7; if 70 be divided by 9, and the quotient will be 7 and remainder 7; if 700, then the quotient will be 77 and remainder 7. If any number be divided by 9, the remainder will be equal to the sum of the figures of the said number taken in their simple value, or to the excess above the 90 contained in the said sum. For if the number be resolved into its constituent parts, the significant figure of each will be the remainder of that part when divided by 9; and consequently the remainders of the several parts will be the figures of the given number, out of which, if the 9s also are taken away, the excess will be the remainder.

2. Hence, the remainder arising from a number divided by 9 is found by adding the figures of the said number.

3. Hence, also any numbers expressed by the same figures, however they may be arranged, have always the same remainder when divided by 9, because the sum of the figures is the same, which shews that the proof of any process by casting out the 9s. may come out, although something in the process be wrong.

CONTRACTIONS IN DIVISION.

1. In dividing by unity, the quotient will be found just equal to the dividend; therefore in dividing by 1, and any number of ciphers, if as many places are cut of from the right of the dividend, as there are ciphers to the right of 1 in the divisor the number to the left of the separating point in the dividend will be the integral part of the quotient, and that to the right will be the remainder, or fractional part,

EXAMPLES.

Quot. Rem.	Quot. Rem.	Quot. Rem.
1000)4578. 567	1000) 545. 78	10000)597. 8451

2. For the same reason, when there are ciphers to the right of any divisor, an equal number of ciphers or figures may be cut off from the right of the dividend, and the remaining figures to the left being divided by the significant figures in the divisor, will quote the integral part, and the figures on the right of the point, annexed to the last remainder, will give the fractional part.

EXAMPLES.

(1.)

25|000)35784675|000(1431387
25
———
107
100
———
78
75
———
34
25
———
96
75
———
217
200
———
175
175
———
0

(2.)

35|00)37645|67(1075$\frac{2067}{3500}$
35
———
264
245
———
195
175
———
(2067)

Note, As an equal number of ciphers was cut off from both factors, there was nothing to constitute a remainder, and therefore there is no fractional part.

37500) 94685732(2524$\frac{32732}{37500}$
89700)917643856(10420$\frac{28856}{89700}$
47350)493287560(
98100)827859770(

3. When

3. When the divifor confifts but of one or two figures, the operation may be performed by a mental multiplication and fubtraction; in which cafe, no part of the work needs to be noted but the quotient, and it may ftand as in any of the fubjoined

EXAMPLES.

(1.)

$$5)\underline{47856743}$$
$$9571348\tfrac{3}{5}$$

$$6\,|\,\underline{74325984}$$
$$12387664$$

$$9\,|\,\underline{748567456}$$
$$83174161\tfrac{7}{9}$$

(2.)

$$\frac{8007456}{70}=114392\tfrac{16}{70}$$

(3.)

$$75645\div25=3025\tfrac{20}{25}$$

$$8\,|\,\underline{759326864}$$
$$94491585\tfrac{8}{}$$

$$12\,|\,\underline{843725836}$$
$$70310486\tfrac{4}{12}$$

4. When the divifor is a compofite number, divide by its component parts continually, and the laft quotient gives the integral part of the anfwer. For the fractional part, multiply the laft remainder by the laft divifor but one, and to the product add the remainder belonging to that divifor; multiply this fum by the next preceding divifor, to which add its correfpondent remainder; and thus proceed, till you have multiplied by the firft divifor, and added in the firft remainder.

EXAMPLE.

Divide 7456785 by 75.

$$75=3\times5\times5\;)\;\underline{7456785}$$
$$5\;)\;\underline{1491357}$$
$$3)\underline{298271}\;:\;2$$
$$99423\;\;2$$

The remainder is found by faying $2\times5+2\times5=\frac{66}{75}$

Or the remainders may be valued, as in the following

EXAMPLE.

Divide 37841 by 48.

$$48=8\times6)\underline{37841}$$
$$8)\underline{6306\tfrac{5}{6}}$$
$$788\text{ Rem. }2\tfrac{5}{6}=\tfrac{17}{48}$$

For 2 when reduced to 6ths $=\frac{2}{}$ and $\frac{2}{6}\times\frac{5}{6}=\frac{17}{6}$, but $1\times17=\frac{17}{}$

$$8\times6=48$$

5 |41589769 ÷ 125

5 |8317953—4

5 |1663590—3

332718 $\frac{19}{125}$ for $3\times5+4=19$

4 |234786 ÷ 168

7 |58696—2

6 |8385—1

1397—3 In all $\frac{90}{168}$ for $3\times7+1\times4+2=90$

4 |478976,845 ÷ 504000

6 |119744

7 |19957—2

3 |2851—

950—1 In all 176845

For $1\times7\times6+2\times4=176$

The last method will be found to be most convenient for practice, but it will be best understood when we have come to reduction of vulgar fractions.

5. When both factors are commensurable, it will shorten the division considerably, to abridge both factors according to the following method.

57456 by 56.

4)56	57456	11)88	47415665
2)14	14364	8	4310515
7	7182		538814$\frac{3}{8}$
	1026 Quotient.		

This and the preceding contraction are founded on the same principles, *viz.* That if equal quantities be divided by equal quantities, the quotients will be equal; and though they may

may at firft view feem to be one and the fame, they will b differently applied, as may be obferved in the fequel.

6. To divide by a whole number and a fraction

Multiply the whole number by the denominator, or lower member of the fraction, and to the product add the upper member or numerator for a new divifor, then multiply the dividend by the fame denominator for a new dividend, and the quotient arifing from thefe two factors will give the anfwer.

EXAMPLES.

$$
\begin{array}{r|r}
3\frac{3}{4} & 567438975 \\
\overline{15} & 3 \\
 & 1702316925 \\
\hline
 & 113487795
\end{array}
$$

$$
\begin{array}{r|r}
12\frac{3}{5} & 7864976329 \\
\overline{63} & 5 \\
\hline
 & 39324881645 \\
\hline
 & 627061756\frac{17}{63}
\end{array}
$$

The reafon of this operation will be evident, if it be confidered that the fame proportion ftill fubfifts between any two factors multiplied or divided by the fame number. *See* Algebra.

$$
\begin{array}{r|l}
24\frac{5}{6} & 897325987(\\
59\frac{7}{8} & 397854986(\\
94\frac{3}{7} & 849765987(
\end{array}
$$

Supplement to contractions in multiplication.

1. The fhorteft method of multiplication, when the multiplier is any even part of 100, 1000, *&c.* is by divifion: for if the multiplicand is increafed by number of ciphers equal to the places in the multiplier, and a part of that product taken for the proportion the multiplier bears to 1, and the fame number of ciphers annexed to it, the quotient will be the true product

Multiply 74185 into 125.
125 is of $1000\frac{1}{8}$, wherefore
8) 74185000

9273126 Product.

Multiply 4759345 into $333\frac{1}{3}$
3) 4759345000

$1586448333\frac{1}{3}$ Product.

3. To multiply by a whole number and a fraction, find the product of the integral part as before, and take part of the multiplicand for the fraction.

Multiply	3475 by $5\frac{1}{2}$	54789	6758	*Note*, $\frac{1}{4}$ of $3=\frac{3}{4}$ of 1.
	$5\frac{1}{2}$	$4\frac{2}{3}$	$3\frac{3}{4}$	
	17375	219156	4)20274	
	$1737\frac{1}{2}$	18263	$5068\frac{1}{2}$	
		18263		
	$19112\frac{1}{2}$	255682	$25342\frac{1}{2}$	

3. The digit 9 hath a property peculiar to itself, that whatever other digit, with any number of ciphers annexed, is divided by it, the quotient will consist wholly of such digits, and so many 9ths of an unit over; hence the following method of multiplying by repetends.

EXAMPLES.

(1)	(2)	(3)
575 by 666.	4745 by 7777.	3987 by 5555.
6000	70000	50000
9)3450000	9)332150000	9)189350000
383333	3690555	22150000
383 Subtract	3690 Subtract	2215
382950 Product.	3686865 Product.	22147785

This last contraction will be demonstrated immediately after division of decimals, where it will be better understood.

CHAP.

CHAP. VI.

ESSAY on MONEY, WEIGHTS, and MEASURES.

IN the preceding chapters we have endeavoured, with as much perſpicuity and conciſeneſs as poſſible, to ſhow the properties and combinations of abſtract or pure numbers, as far as concerned the fundamental rules of arithmetic, in a method that leads gradually to eaſe, diſpatch, and certainty in calculation. But before we can ſhow the uſe of theſe rules in matters of buſineſs, it will be proper to give ſome account of the monies, weights, and meaſures, which the Britiſh merchant hath occaſion to be acquainted with; as a proper knowledge of theſe is not only intimately connected with, but a *ſine qua non* in the mercantile buſineſs.

I. OF MONEY.

IN the firſt ages of commerce, there was little occaſion for computation, as one commodity was bartered for another by the bulk; a cuſtom which, even at this day, prevails among the ſavage unpoliſhed nations of Chili on the South Sea, in the land of Jeſſo on the Pacific Ocean, and other barbarous countries; but by degrees, as improvements were made in the world, ſomething new was added daily, to the conveniencies of life, and as ſuch a method of barterting commodities was found to be difficult and inconvenient, it was agreed among mankind to make choice of one commodity, which being in general and conſtant eſteem, an equivalent quantity of it might always remove the difficulty of bartering in kind. To determine therefore this ſubſtance that ſhould be in univerſal and conſtant eſteem, they made choice of gold and ſilver, not only becauſe they were diviſible and portable, but becauſe they were more valuable than other metals. Since there was a conſiderable difference in the nature of theſe two metals, and gold was more precious than ſilver, both on account of its rarity and intrinſic worth: beſides, the expence in working gold far exceeds the charge which attends the working ſilver, as appears by the tax paid upon each to the ſovereign lords of mints, that upon gold being only 5 of the hundred, and that on ſilver 20; it was therefore juſt to aſcribe a greater value to gold. And becauſe the baſer metal ought to be given in greater meaſure, that what wanting in quality might be made up in quantity, it was likewiſe

likewiſe found neceſſary to fix a proportion between them by ſome certain and determinate rule; whence it is, that, in the practice of commerce, though formerly the proportion of gold to ſilver was ſettled as ten to one, yet the matter is ſo ſettled at preſent, throughout the greateſt part of Europe, that 1 ounce of gold is worth about 15 ounces of ſilver. When this ſubſtance was agreed upon at firſt to be a common equivalent for any of the conveniencies of life, the particular quantity of it to be given as the value of any thing elſe, was determined by the bulk and weight only: but afterwards, to ſave the trouble of proving this weight upon every occaſion, it was coined into certain forms by public authority, and impreſſed with a mark of diſtinction, expreſſing the quantity each piece contained, ſo that it ſhould always have the ſame determined value, and be every where the ſame both for matter and weight.

In Britain, as in all other trading places, the current money or ſpecie, is either gold, ſilver or copper. The ſtandard of gold coin 22 carats of fine gold mixed with 2 carats of alloy in the pound weight Troy; and the ſtandard of ſilver coin is 11 ounces and 2 pennyweights of fine ſilver, mixed with 18 pennyweights of copper. Theſe maſſes being thus proportioned, and reſpectively divided into pieces of a certain weight, upon which the current ſtamp, authoriſed by the Prince, is impreſſed, conſtitute the ſeveral coins we meet with in Britain; the value whereof is determined by an imaginary piece, called the *pound Sterling*, by which we buy and ſell, and keep all accounts.

The diviſion of the pound Sterling is as follows.

Farthings, marked -	*qrs.*
4= 1 penny, -	*d.*
48= 12=1 ſhilling,	*s.*
960=240=20=1 pound,	*L.*

When ſhillings and pence are wrote together, they are often in figures diſtinguiſhed thus, 4|5, *i. e.* 4*s.* and 5*d.* 10|, *i. e.* 10*s.* and |10, *i,e.* 10 *d.*

The coins uſed in Britain, with their value.

Gold Coins.	*L.*	*s.*	*d.*
The Guinea,	=1	1	0
Half Guinea,	=0	10	6
Quarter guinea,	=0	5	3
Silver Coins.			
The Crown,	=0	5	0
Half Crown,	=0	2	6
Shilling,	=0	0	6
Sixpence,	=0	0	6
Copper Coin.			
The Halfpenny,	=0	0	½
Farthing,	=0	0	¼

There

There are ſome gold pieces bearing the ſtamp of other countries which are likewiſe current in Britain, namely, the Moidore, =*L*. 1, 7*s*. and the Joannes, =*L*. 3, 12*s*. and the half and quarter ditto.

The pound of gold Troy, including the alloy, is divided into $44\frac{1}{2}$ parts, which are ſtamped into guineas, and into 89 parts, when ſtamped into half-guineas.

OBSERVATION.

If an exact proportion between gold and ſilver is not maintained, and fixed unalterably, according to ſome univerſal rule adapted to the generality of the European nations, the conſequence may be dangerous to a kingdom in the affair of money.

Suppoſe that in ſome particular kingdom a money-ſyſtem prevails, that ſhall raiſe the gold above its real value, and that in this regulation, inſtead of the common proportion of 1 to 15, that now obtains, an ounce of gold is allowed to be equivalent to 16 ounces of ſilver, ſince ſuch an alteration would raiſe the gold $6\frac{2}{3}$ *per cent.* above its value, and reduce the ſilver to juſt ſo much below its worth; it is evident that this increaſe of the current price of gold would naturally cauſe the ſilver to be exported out of the kingdom; and as gold would be imported in its ſtead, and increaſe greatly, the nation muſt unavoidably loſe $6\frac{2}{3}$ *per cent.* of all the ſilver that would be thus exported.

On the other hand, ſhould the ſilver money be raiſed above its value, ſo that 14 ounces ſhould be deemed equivalent to one ounce of gold, while the proportion ſhould ſtand thus, the ſilver money would not only continue in the kingdom, but alſo increaſe greatly, and the gold coin would be exported in the ſame proportion; by which means the nation would ſuſtain a loſs of $7\frac{1}{7}$ *per cent.* Moreover from theſe variations two abſurdities would follow: the one is, that both the Prince and the people would loſe of that part of their monied property $6\frac{2}{3}$ *per cent* ſhould the above diſproportion fall upon the gold coin, and $7\frac{1}{7}$ ſhould it fall upon the ſilver. The other inconvenience would be, that there would be no ſpecie to circulate in the kingdom, but either gold only, or ſilver only, according as the one or the other of theſe metals ſhould happen to be eſtimated above its true proportion. To maintain an exact proportion therefore between gold and ſilver, are eſſential points of good conduct, with regard to the pre-

ſervation of money, that are by no means to be neglected. There is another conſideration, however, that hath a ſurpriſing effect on the money-matters of a kingdom, and that is, the balance of trade; which when it is againſt a nation, its money muſt be carried to foreign nations, to pay for the exceſs of goods imported above thoſe which have been exported; but if it is in its favour, the money will not only continue in it, but alſo increaſe and multiply.

The Laws of ENGLAND relating to MONEY.

By 20th *Edw.* I. merchants are prohibited from trafficking with money, and importing clipped coin, under the pain of forfeiture.

9th *Edw.* III. *c.* 1. Gold or ſilver plate, or coin, not to be exported without licence, under the pain of forfeiture. Search to be made for falſe coin imported.

Money not to be impaired in weight or alloy. 25th *Edw.* II. *c.* 13.

No coin to be current but the King's own, and any perſon may refuſe foreign coin. 27th *Edw.* III. *c.* 14.

Foreign coin not to be current in England, but to be melted down. 17th *Rich.* II. *c.* 1.

Coin or plate found in the cuſtody of perſons ready to paſs the ſeas, or in any ſhip, to be forfeited to the King. 2d *Hen.* IV. *c.* 5.

Treaſon to clip or file money. 3d *Hen.* V. *c.* 6.

Gold to be received in payment by the King's weight. 9th *Hen.* V. *c.* 11.

The mint maſter to keep to his alloy, and to receive ſilver at the true value, on pain of double damages. 2d *Hen.* VI. *c.* 12.

Coins of gold and ſilver to continue current, notwithſtanding they may be cracked or worn, but not if they are clipped; monies clipped to be exchanged at the mint. Coin tranſported to Ireland above 6*s.* 8*d.* or Iriſh coin imported above 3*s.* 4*d.*, to be forfeited. A circle to be made round the outſide of money. 14th 15th *Hen.* VIII. *c.* 12.

Counterfeiting, impairing, &c. of coin, or foreign coin made current, is made high treaſon by 14th *Eliz. c.* 3. and 4. and by 18th *Eliz. c.* 1. and 7.

Silver coin melted down to be forfeited, and double value. 13th and 14th *Ch.* II. *c.* 31.

Gold and ſilver delivered into the mint to be aſſayed, coined, and delivered out, according to the order and time of bringing in. 18th *Ch.* II. *c.* 5.

Buying

Buying or ſelling clippings or filings, *L.* 500 penalty. Perſons melting coin to be impri oned ſix months, beſides forfeiture, *&c.* Perſons apprehending money coiners, *&c.* to have *L.* 40 reward; and guilty perſons diſcovering two others, to be pardoned, 6th and 7th *Will.* III. *c.* 17.

Perſons bringing plate to the mint to be coined, not to pay for coinage, but to have the ſame weight of money delivered out. Perſons keeping public houſes to have no manufactured plate but ſpoons. Molten ſilver or bullion not to be ſhipped off, without a certificate from the Lord mayor, that oath hath been made that it is foreign bullion, under the penalty of *L.* 200; and officers may ſeize the bullion as forfeited, Gold or ſilver not exceeding *L.* 200,000, may be exported with a licence Guineas not to go for more than 22 *s.* 7th and 8th *Will.* III. *c.* 19.

Hammered ſilver coin brought to the mint, to be received at 5 *s.* 4 *d. per* ounce; receivers of taxes, *&c* to receive money at 5 *s.* 8 *d. per* ounce, to be delivered back to the bringers-in; and receivers, *&c.* to be paid into the exchequer, with an allowance of the deficiency in recoining, Silver plate, *&c* to contain 11 ounces and 10 pennyweights of fine ſilver in every pound, and to be marked with the two initial letters of the worker's name, on pain of forfeiture. Plate received at 5 *s.* 4 *d. per* ounce to be melted down. 8th and 9th *Will.* III. *c.* 7. and 8.

It is made high treaſon to make any ſtamp, die, mold, *&c.* for coining, excepting by perſons employed in the mint, *&c.* Conveying ſuch out of the mint, the ſame. Colouring metal reſembling coin like gold or ſilver, or marking it on the edges, is likewiſe high treaſon; and mixing blanched copper with ſilver, to make it heavier and look like gold or receiving or paying counterfeit milled money, is felony. 8th and 9th *Will.* III. *c.* 26.

Hammered ſilver coin may be refuſed in payment, as not being the lawful coin of this kingdom. 9th *Will.* III. *c.* 2.

Any perſon may cut, break, or deface pieces of ſilver money, ſuſpected to be counterfeit, or diminiſhed otherwiſe than by wearing, but if they ſhould, upon trial, appear to be lawful money, *&c.* to ſtand to the loſs, 9th and 10th *Will.* III. *c.* 21.

No perſon to make or coin any farthings or halfpence, or pieces to go for ſuch, of copper, under the penalty of *L.* 5. or every pound weight. 9th and 10th *Will. c.* 33.

On a ſcarcity of ſilver coin, ſor remedy guineas were ſunk to 21 *s.* by proclamation, 3d *Geo.* I.

Perſons counterfeiting broad pieces of gold, or uttering them knowingly, to be guilty of treaſon. 6th *Geo.* II. *c.* 26.

Waſhing, gilding, or altering the impreſſion of any real or counterfeit ſhilling, or ſixpence or braſs-money, to make the one paſs for a guinea, or half-guinea, or the other for a ſhilling or ſixpence, is high treaſon. Knowingly uttering falſe money, for the firſt offence ſix months impriſonment, for the ſecond two years impriſonment, and for the third felony without benefit of clergy. If any perſon, knowingly, uttering falſe money, ſhall have about him any other falſe money, he ſhall ſuffer one years impriſonment; and coiners of halfpence or farthings, two years impriſonment, &c. 15th *Geo.* II. *c.* 28.

Quarter-guineas were ordered to be coined in the 1ſt *Geo.* III. of which ſome had been ſtruck in the reign of *Geo.* I. but were become ſo rare, that they were ſcarcely to be met with.

The Diviſion of the Jewiſh Talent, was as under:

					L	*ſh.*	*d.*
10 Gerahs,	=	1	Bekah,	=	0	1	$2\frac{1}{2}$
2 Bekahs,	=	1	Shekel,	=	0	2	$4\frac{1}{2}$
60 Shekels,	=	1	Mina,	=	7	1	5
50 Minas,	=	1	Talent,	=	353	11	10
The Babyloniſh			Talent,	=	1240	12	6

The Attic Talent was divided as under:

					L.	*ſh.*	*d.*
The Drachm,				=	0	0	$8\frac{1}{2}$
100 Drachms,	=	1	Mina,	=	3	8	9
60 Minas,	=	1	Talent,	=	206	5	0

Coins among the Romans were,

			d
Braſs Coins	The As,	=	$\frac{3}{4}$
	The Sextans,	=	$\frac{1}{24}$
	The Sconis,	=	$\frac{3}{8}$
	The Uncia,	=	$\frac{1}{16}$
	The Semiuncia,	=	$\frac{1}{32}$
	The Decuſſis,	=	$7\frac{1}{2}$
	The Viceſſis,	=	$\frac{1}{3}$
	The Centuſſis,	=	$\frac{6}{3}$

Firſt ſtamped by Servius Tullius, with the image of a pecus, whence pecunia became the general name of money It was afterwards ſtamped with the beak of a ſhip upon one ſide, and on the reverſe a Janus. The Sextans was the general contribution for the funeral of M. Agrippa.

1 Denarius

			d.	
Silver Coins	1 Denarius,	= 10 Affes,	= $7\frac{1}{2}$	First coined after the war with Pyrrhus, A. U. C. 484, with the impreffion of a waggon upon one fide, and on the reverfe, the head of Rome with an helmet.
	1 Victoriatus,	= $\frac{1}{2}$ den.		
	1 Seftertius,	= $\frac{1}{4}$ den.		
	1 Obolus,	= $\frac{1}{6}$ den.		
	1 Libella,	= $\frac{1}{10}$ den.		
	1 Sembolla,	= $\frac{1}{10}$ den.		
	1 Teruntius,	= $\frac{1}{40}$ den.		
Gold Coins	The Aurei denarii,	= 17s 1d.		Stamped during the Commonwealth.
	The Imperial Aureus,	= 15s.		

The Romans expreffed an As by L, the Seftertius H S, or LLS. The Victoriatus by Λ, and the Denarius by X.

The Sums ufed among the Romans were,

			L.	s.	d.
The Seftertium,	= 1000 Seftertii,	=	*L.* 7	16	3
The Libra,	=		3	0	0
The Talent,	= 24 Seftertia,		187	10	0

II. OF WEIGHTS.

As the fecurity of commerce depends much on the juftnefs of weights, moft nations have taken care to prevent their being falfified. The ftandard of weights in Britain is kept in the exchequer, by a particular officer, called the *clerk* or *comptroller of the market*. By the 27th chapter of *Magna Charta*, the weights are to be the fame all over England; but as commerce flourifhed, and introduced greater variety of commodities, it was found convenient to vary the original weight, and likewife invent others better calculated for difpatch in bufinefs, which hath introduced a diverfity of weights, in almoft every different country or province. The firft of all the weights ufed in Britain was a grain of wheat picked out of the middle of the ear, which, being well dried became the leaft denomination of Troy weight, now ufed for gold, filver, jewels, feeds, liquors, bread, and medicines.

TABLE OF TROY WEIGHT.

Grains.			
24 =	1 pennyweight,		*dwt.*
480 =	20 =	1 ounce,	*oz.*
5760 =	240 =	12 = 1 pound,	*lb.*

APOTHE-

APOTHECARIES WEIGHT,

Is deduced from Troy; but convenience taught them to vary the division, for compounding their medicines, according to the following

TABLE.

Grains.						
20 =	1 scruple,					℈
60 =	3 =	1 dram,				ʒ
480 =	24 =	8 =	1 ounce,			℥
5760 =	288 =	96 =	12	1 =	pound,	℔

AVOIRDUPOISE WEIGHT.

Was rather introduced by chance, and confirmed by custom, than fixed by any law. The Troy weight was in practice found to be too small for coarse and heavy goods, such as grocery wares, pitch, tar, rosin, wax, tallow, flax, hemp &c. copper, tin, iron, lead, steel, fish, flesh, butter, cheese, salt, &c; for which, and other such goods, it was thought proper to allow a greater weight than the law had provided, which in this weight exceeds the Troy by $\frac{1}{6}$, one pound Avoirdupoise being equal to 1 lb. 2 oz. 11 dwt. $15\frac{1}{2}$ grains Troy. In lead, they give only $19\frac{1}{2}$ cwt. to the ton or fodder.

TABLE of AVOIRDUPOISE GREATER WEIGHT.

lb.			
28 =	1 quarter, *qr.*		
112 =	4 =	1 hundred weight, *cwt.*	
2240 =	80 =	20 =	1 tun.

Ditto LESSER WEIGHT.

Drops.			
16 =	1 ounce.		
256 =	16 =	1 pound.	
3584 =	224 =	14 =	1 stone

After the Union, when the weights in Scotland were attempted to be reduced to English standard, it was found that the Scots Troy pound was equal to 7600 grains; and the English Avoirdupoise to 7000: hence the Scots, Paris, or Amsterdam pound will be to the pound Avoirdupoise as 38 to 35. Besides the Scots Troy weight commonly known by the name of *Dutch weight*, whereof a table is subjoined there is another weight derived from it, called *Tron weight*, which in different places, consists of a heavier or lighter pound

pound, according as cuſtom hath eſtabliſhed it. The pound Tron weight runs from 20 to 24 ounces generally, and in ſome places, but rarely, falls as low as 19 ounces.

TABLE of Scots Troy, or Dutch Weight.

Grains.				
36=	1 drop.			
576=	16=	1 oz.		
9216=	256=	16=	1 lb.	
147456=	4096=	256=	16=	1 ſtone

Note, The Tron weight is divided in the ſame manner as the Troy in the adjacent table, excepting the pound into ounces, of which there is no certain regulation.

Wool weight is founded on, and derived from Avoirdupoiſe weight, the pound in both being the ſame, but the greater weights different.

TABLE of Wool Weight.

Pounds					
7=	1 clove				
14=	2=	1 ſtone			
28=	4=	2=	1 todd.		
182=	26=	13=	$6\frac{1}{2}$=	1 wey	
364=	52=	26=	13 =	2=	1 ſack.
4368=	312=	624=	156 =	24=	12= 1 laſt.

Note 1. Some few authors make 8 pound in the clove.

2. Woolſtaplers generally purchaſe their wool by the todd, but ſell it again, when ſorted and ſtapled, by the pack, conſiſting of 240 pounds.

The REFINERS WEIGHTS.

Blanks.			
24=	1 perrot		
480=	20=	1 mite	
8600=	400=	20=	1 grain.

Note, What they denominate *carats* are the $\frac{1}{24}$ of a lb. an oz. or any other weight.

The Weights for Merchandizes uſed in Holland.

24 grains = 1 drachm; 3 drachms, or 72 grains, = 1 groſs; 30 grains = 1 engels; 10 engel, or 4 groſs and 2 grains = 1 loot;

loot; 16 loots, or 8 ounces, = 1 mark; 2 marks = 2 pound; 8 pound = 1 ſtone; 165 pounds = 1 waggon, or wage 400 pounds = 1 load; 15 pounds = 1 liſpond; 20 liſpond = 1 ſchippound.

DUTCH WEIGHTS for GOLD and SILVER.

32 aces = 1 engel, 20 engels = 1 ounces, 8 ounces = 1 mark, for groſs gold.

24 parts = 1 grain, 12 garins = 1 carrat, 24 carats = 1 mark, for fine gold.

Note, The mark weights are about 1 *per cent.* lighter than the Troy weight of London.

WEIGHTS for MERCHANDIZE uſed in HAMBURG,

2 loots = 1 ounce, 16 ounces = 1 pound, 10 pounds = 1 ſtone of wool or feathers, 14 pounds = 1 diſpound, 20 pounds = 1 ſtone of flax, 8 diſpound, = 1 center = 129 pound Avoirdupoiſ of London. 16 pounds of feathers or wool is a diſpound, and 20 diſpounds = 1 ſchippound of the ſame. 16 diſpounds = 1 tun of butter or tallow.

100 pounds of Hamburg = 98 of Amſterdam = $103\frac{1}{2}$ of Antwerp = $107\frac{1}{4}$ of London. *See* the table in the compariſon of weights and meaſures.

The Jewiſh talents, their greateſt weight, was divided as under:

			lb.	oz.	dwt.	g.	Troy
1 ſhekel	=		0	0	9	3	
100 ſhekels	=	1 manch	3	9	12	12	
30 manchs	=	1 talent	114	0	15	0	

The Roman pound or libra as under.

4 grana	=	1 ſiliqua.				
3 ſiliquæ	=	1 obolus.				
2 oboli	=	1 ſcrupulum.				
3 ſcrupula	=	1 drachma.				
8 drachma	=	1 uncia.				
12 unciæ	=	1 libra.				

The As as follows:

2 unciæ	=	1	ſextans.
3 do.	=	1	quadran.
4 do.	=	1	triens.
5 do.	=	1	quicunx.
6 do.	=	1	ſemis.
7 do.	=	1	ſeptunx.
8 do.	=	1	bes.
9 do.	=	1	dodrans.
10 do.	=	1	dixtans.
11 do.	=	1	deunx.

The

The weight of the Roman pound has never yet been ascertained with precision, some making it equal to our pound Troy, others to 13 ounces Avoirdupoise, and consequently to 10 oz. 18 dwt. 18 grains Troy; and others only to 10 oz. 10 dwt. 15 grains Troy, from the weight of water contained in the amphora.

III. MEASURES.

The same necessity that introduced money and weights, may justly be supposed to have introduced measures as the most certain method of ascertaining quantities bought and sold. The common measures used in Britain are those which follow.

I. CLOTH MEASURE, which is of four kinds.

1. The yard=4 quarters=16 nails=36 inches; by which are measured and sold all kinds of English woollen cloths, linen, wrought silks, tape, *&c.*

2. The English ell=$1\frac{1}{4}$ yard=20 nails=45 inches, by which is measured chiefly a species of fine linen called *Holland*.

3. The Flemish ell=$\frac{3}{4}$ yard=12 nails=27 inches, chiefly applied to tapestry.

4. The Scots ell=$1\frac{1}{36}$ yard=37 inches, by which green linen, and most of the private or house manufactures in the country, are bought and sold.

II. CORN MEASURES, which are of two kinds.

1. English, in which the pint is found to weigh 1 pound Troy, and the several denominations are as follow.

TABLE of ENGLISH DRY MEASURE.

Pints.							
8=	1 gallon.						
16=	2=	1 peck.					
64=	8=	4=	1 bushel.				
256=	32=	16=	4=	1 comb.			
512=	64—	32=	8=	2=	1 quarter.		
2560=	320=	160=	40=	10=	5=	1 wey.	
5120=	640=	320=	80=	20=	10=	2=	1 last.

Corn, salt, coals, lead-ore, and any other dry goods, are measured according to this table. Corn is generally sold in England by the quarter, 5 whereof are reckoned to the ton of freight. The ton of wheat weighs between 2200 and 2500 pounds Avoirdupoise; of rye, between 2100 and 2240 pounds ditto; and of barley, between 1700 and 1800.

By the standard in his majesty's exchequer, every round bushel with a plain and even bottom, $18\frac{1}{2}$ inches wide throughout, and 8 inches deep, is esteemed a legal corn bushel, and will contain $2150\frac{21}{50}$ cubic inches; consequently the corn-gallon contains $268\frac{4}{5}$ cubic inches.

2 Scots, in which the boll of meal weighs 8, and amongst the farmers in the north, frequently 9 stone Dutch or Scots Troy weight, is divided as follows.

Lippies.				
4=	1 peck.			
16=	4 =	1 firlot.		
64=	16 =	4=	1 boll.	
1024=	256=	64=	16=	1 chalder.

Note, The wheat firlot in Scotland contains $21\frac{1}{4}$ pints Scots measure, and the bear or barley firlot 31; hence the Scots wheat firlot is to the English corn bushel as 100 to $99\frac{21}{100}$.

3. Liquid measure was originally raised from Troy weight as is evident from several statutes, enacting, that 8 pounds Troy of wheat, properly prepared, should weigh one gallon of wine measure, the divisions and multiples whereof should form the other measures, and be the common standard throughout the whole kingdom; yet the invention of a new weight introduced likewise a new gallon adjusted thereto, exceeding the former in the proportion of Avoirdupoise weight to Troy, which serves to proportion the several proportions of ale and beer measure. The sealed gallon at Guildhall, which is the standard for wines, spirits, mead, perry, cyder, vinegar, honey, oil, &c. is supposed to contain 231 cubic inches, on which supposition, the other measures raised therefrom will contain proportionally; yet, by actual experiment, made in 1688, in presence of the Lord Mayor and commissioners of excise, this gallon was only found to contain 224 cubic inches, notwithstanding it was agreed to continue the computation, upon the supposition of 231 cubic inches to the gallon, as before

TABLE

TABLE of WINE MEASURE.

Solid inches.

231 = 1 gallon.
4158 = 18 = 1 runlet
7276$\frac{1}{2}$ = 31$\frac{1}{2}$ = 1$\frac{3}{4}$ = 1 barrel.
9702 = 42 = 2$\frac{1}{3}$ = 1$\frac{1}{2}$ = 1 terce.
14553 = 63 = 3$\frac{1}{3}$ = 2 = 1$\frac{1}{2}$ = 1 hogshead, (*hhd.*)
19279 = 84 = 4$\frac{2}{3}$ = 2$\frac{2}{3}$ = 2 = 1$\frac{1}{2}$ = 1 puncheon.
29106 = 126 = 7 = 4 = 3 = 2$\frac{1}{4}$ = 1$\frac{1}{2}$ = 1 butt.
58212 = 252 = 14 = 8 = 6 = 4$\frac{1}{2}$ = 3 = 2 = 1 tun.

Ale and beer meaſure, as was formerly obſerved, is deduced from the Avoirdupoiſe weight, and therefore the gallon muſt be much larger than the gallon in wine meaſure. The ſtandard ale quart, kept in the exchequer, hath been found by experiment to contain juſt 70$\frac{1}{2}$ cubic inches; conſequently the ale gallon muſt contain 282 cubic inches. Hence.

ALE-MEASURE TABLE.

Cubic inches.

282 = 1 gallon.
2256 = 8 = 1 firkin.
4512 = 16 = 2 = 1 kilderkin.
9024 = 32 = 4 = 2 = 1 barrel.
13536 = 48 = 6 = 3 = 1$\frac{1}{2}$ = 1 hhd.

TABLE of BEER MEASURE.

Solid inches.

282 = 1 gallon.
2538 = 9 = 1 firkin.
5076 = 18 = 2 = 1 kilderkin.
10152 = 36 = 4 = 2 = 1 barrel.
15228 = 54 = 6 = 3 = 1$\frac{1}{2}$ = 1 hhd.
30456 = 108 = 12 = 6 = 3 = 2 = 1 butt.

Note. This diſtinction, or difference betwixt ale and beer meaſure, is only uſed in London; for, in all other places, the following table of beer or ale, whether ſtrong or ſmall, is to be obſerved, according to a ſtatute of exciſe made in the year 1689.

Note, In meaſuring ſoap and herrings, 8 gallons is conſidered as a firkin.

Cubic inches.						
$35\frac{1}{4}$ =	1 pint.					
282 =	8 =	1 gallon.				
2397 =	68 =	$8\frac{1}{2}$ =	1 firkin.			
4794 =	136 =	17 =	2 =	1 kilderkin.		
9588 =	272 =	34 =	4 =	2 =	1 barrel.	
14382 =	408 =	51 =	6 =	3 =	$1\frac{1}{2}$ =	1 hhd,

In Scotland, the excise and breweries use the English measures; but retailers and victuallers in the country use the Scots pint, of $103\frac{2}{5}$ solid inches, whose divisions and multiplies are as follow.

4 gills = 1 mutchkin, 2 mutchkins = 1 chopin 2 chopins = 1 pint, 2 pints = 1 quart, and 4 quarts = 1 gallon.

4. Long measure, among other improvements, took its rise from wheat, three grains of which, properly prepared, were, in length, made the measure of an inch, as in the

TABLE.

Grains.						
3 =	1 inch.					
36 =	12 =	1 foot.				
108 =	36 =	3 =	1 yard.			
594 =	198 =	$16\frac{1}{2}$ =	$5\frac{1}{2}$ =	1 pole		
23760 =	7920 =	660 =	220 =	40 =	1 furlong	
190080 =	63360 =	5280 =	1760 =	320 =	8 =	1 mile.

Note, 4 poles, or 22 yards, is the length of Gunter's chain, consisting of 100 links, each link = $7\frac{92}{100}$ inches. But the chain for surveying in Scotland should be 74 feet.

Note, 3 miles = 1 league, and 20 leagues = 1 degree, by common reckonings; but a degree of a great circle, measured upon the surface of the earth, has been found, by the best geographers, to be equal to $69\frac{1}{2}$ English miles = 25 French leagues.

Different countries divide a degree differently.

In Italy	into 60	miles =		$69\frac{1}{2}$ English.
In Germany	—— 15	—— =		
In Spain	—— 22	—— =		
In Sweden	—— 15	—— =		
In Hungary	—— $12\frac{1}{2}$	—— =		
In Scotland	—— 56	—— =		

5. Square

5. Square measure was founded upon long measure, and is differently divided in England and in Scotland.

In English square measure, 144 square inches = 1 foot square, 9 feet square = 1 square yard, $30\frac{1}{4}$ square yards = 1 pole, 40 poles = 1 rood, and 4 roods 1 acre.

Though the statute pole be $16\frac{1}{2}$, feet in measuring fens and woodlands they use a pole of 18 feet, and for forests 21 feet. 40 poles in length, and 4 in breadth, or 220 yards in length, and 22 in breadth, make a statute acre. The French acre, or arpens, is $26\frac{1}{8}$ yards in breadth, and $261\frac{3}{8}$ yards in length and is to our statute acre as 19 to 16.

Masons measure their hewn work by the English foot, painters and plasterers, by the yard. Glaziers reckon only 8 inches to their lineal foot, and 64 to their square foot.

The square measure used in Scotland is thus divided;
36 square ells = 1 fall, 40 falls = 1 rood, and 4 roods = 1 acre.

The Scots acre by statute is to the English as 100,000 to 78694.

In Scotland, slaters, masons, and paviers use the square ell and the fall in measuring their work, and the land-surveyors, the fall, the rood, and the acre.

There are some commodities sold by the dozen, of which we reckon 12 = 1 dozen, 12 dozen = 1 small gross, and 12 small gross = 1 great gross,

Paper is sold by the following denominations, in which 24 sheets = 1 quire, 20 quires = 1 ream, and 10 reams = 1 bale.

Parchment thus: 12 skins = 1 dozen, 15 dozen = 1 roll.

Yarn thus: 120 threads = 1 cut, 2 cuts = 1 heer, 6 heers = 1 hank, and 4 hanks = 1 spindle.

In glass, 5 pounds = 1 stone, and 24 stones = 1 seam.

The freight of bale goods is often determined by the tunnage, in which 40 solid feet are reckoned = 1 tun.

OBSERVATION.

The diversity of weights and measures used in Great Britain, must be thoroughly studied by every trader, before he can deal with safety out of his own province, and after all, the reduction is attended with trouble. It were therefore to be wished that the whole weights and measures throughout the kingdom were reduced by Parliamentary authority to an uniform standard, and that the weight or capacity of each, from a tun to a pint bottle were ascertained by a stamp, as it would

would add very considerably to the revenue, and secure the lieges from gross impositions.

Having thus given a brief and succinct account of the measures used in Great Britain, for the benefit of the dealer in foreign spirits, &c. I shall add Mr. Postlethwayt's account of the different measures and vessels used in most parts of the world.

Of Measures for Wine and Vinegar.

The vessels for containing wine and brandy have different names, according to the quantities they contain, and the countries where they are made use of.

The vessel called in Germany, *woeder*, made use of for keeping the wines that grow upon the Rhine and the Moselle do ordinarily contain 14 aams of Amsterdam, but sometimes they contain more and sometimes less.

The aam of Amsterdam is a measure of 4 ankers, reckoning the anker of 2 steckans.

The steckan contains 16 mingles, each of which makes two pints.

The verge, or verteel, of the wines upon the Rhine and the Moselle, &c. is reckoned but 6 mingles, that of brandy is counted $6\frac{1}{8}$ mingles, as we shall see hereafter.

The hogshead of Bourdeaux, according to the just measure, should contain $12\frac{1}{2}$ steckans, or 200 mingles of wine and lee, and 12 steckans, or 192 mingles clear wine; so that the tun of Bourdeaux, consisting of 4 hogsheads, contains 50 steckans, or 800 mingles, wine and lee, and 48 steckans, or 768, mingles clear wine.

The tun of Bayonne, and other places thereabout, is reckoned 240 steckans, measure of Amsterdam, there being likewise 4 hogsheads to a tun.

In England, and especially at London, they reckon the hogshead 63, and the tun 252 gallons. The said gallon weighs $7\frac{1}{2}$ pounds weight of London; so that the 63 gallons. or the hogshead, should weigh $472\frac{1}{2}$ pounds, and the tun 1890 pounds weight of London. The said gallon is said to contain 4 Paris pints.

The hogshead of Bourdeaux should contain 110 pots with the lee, and 100 pots clear wine, measure of the said place; so that the said pot of Bourdeaux contains about 2 mingles of Amsterdam.

The

The Bourdeaux tun of wine ſhould weigh, with the hogſhead, 2000 pounds weight; and, in marine terms in freighting of ſhips, by a tun is meant 2000 pounds weight; ſo that when it is ſaid any ſhip is of ſo many tuns, it is to be underſtood that the ſhip can carry ſo many times 2000 pounds weight: though in Holland, Flanders, and other northern countries, they only talk of laſts, containing 2 tuns each, or 4000 pounds weight.

The Rheniſh and Moſelle wines are ordinarily ſold at Amſterdam; the former at ſo many florins of about 20 each, current money, and the latter ſo many rix dollars, of 50 ſtivers each, current money, for the aam of 20 verges or verteels, the verge being at that rate, 6 mingles, as already ſaid.

French, Spaniſh, and Portugal wines are ſold at ſo many pound groſs the tun of 4 hogſheads, and there is ordinarily 1 *per cent.* rebate for payment in ready money, both buyer and ſeller paying brockerage, each 6 ſtivers, *per* tun.

The muid of Paris contains 150 quarts, or 300 pints with the lee, and 280 pints clear wine, meaſure of Paris.

There are all over France a great many veſſels for keeping of wine, different from one another, according to the cuſtom of the ſeveral provinces where they are made uſe of; of which, though there be ſcarce any poſſibility to give an exact account, we ſhall here ſet down the regular fractions of the muid of Paris, 3 of which make the tun of France; and, as we have occaſion to ſpeak of the meaſures of the other provinces of France we ſhall give as diſtinct an account as we can of their contents.

The pint of Paris is a meaſure pretty well known all over the world; 2 of thoſe pints make 1 quart, 4 quarts 1 ſextier, and 36 ſextiers 1 muid of Paris; 3 of which (as is already ſaid) make 1 tun of France.

The meaſure they make uſe of in Provence is called a *millerole*; that of Thoulouſe ſhould weigh 130 pounds, and ought to contain 66 Paris pints, which is about 100 pints of Amſterdam.

At Montpelier, and ſeveral other places of Languedoc, their muid contains 18 ſextiers, and the ſextier 32 pots; ſo that the muid, which makes but 35 ſteckans, 560 mingles of Amſterdam, makes 756 pots of Montpelier; by which it appears, that the pot of Montpelier is $\frac{1}{38}$ leſs than the mingle of Amſterdam. However, you muſt here take notice, that the

the casks of Montpelier are not all of an equal measure, some being bigger than others; and in several places of Provence, as well as High and Low Languedoc, they frequently transport wines, oils, and other such goods, in vessels made of goat-skins.

The butts and pipes of Seville, Malaga, Alicant, Lisbon, Port a port, Canaries, and isles of Fagel, &c. are likewise of different sizes; for the tun of Malaga, consisting of 2 butts or pipes, (which they call *persemyn* at Amsterdam), is reckoned only 36 or 37 steckans; and those of other places are reckoned at 25 or 26 steckans the but or pipe.

As for the wine at Hamburg and Lubeck, it is sold at so many rix-dollars of 48 stivers, or 3 marks lubs *per* tun.

OF BRANDY.

French, Spanish, and Portuguese brandy, is ordinarily put into big casks, which some call *pipes*, others *buts*, others, *pieces*, *viz.* according to the custom of the places, there being no positive measure regulated for that liquor.

In France it is ordinarily put into great casks, which they call at Bourdeaux, *pieces*, at Rochelle, Nants, Cogniac, Montguion, the isle of Rhé, &c. *pipes*, which (as we have already said) contain some more than others, there being some which hold at Amsterdam from 60 to 90 verges or verteels; and they reduce those measures into hogsheads, by reckoning as under; for,

1 hogshead makes
- 27 verges of Cogniac, Montguion, Rochelle, and the isle of Rhé.
- 29 of Nants, and other places in Britany and Anjou.
- 32 of Bourdeaux, and other places in Guienne.
- 30 of Bayonne, and places thereabouts
- 30 of Amsterdam, and other places of Holland.
- 30 of Hamburg and Lubeck.
- 27 of Embden.

In Provence and Languedoc, they sell it at so much the quintal, or 100 weight with the cask.

At Bruges they call the verges *sesters*, of 16 stoops to a sester, which they sell at so much a stoup.

At London, and generally through all England, they count only by gallons, as we have said already.

The mingle of brandy weighs at Amsterdam, 2 pounds

4 ounces

4 ounces; and the verge, or verteel, about 14 pounds; at which rate, the 30 verges must weigh about 420 pounds.

At Bourdeaux, though pieces of Brandy contain from 50 to 90 verges, they reckon but 32 to the hogshead; the verge is something less than $3\frac{1}{2}$ pots.

You must know, that whatever there is at Bourdeaux in a piece of brandy more than 50 verges, is called by the formers of the King's duty *exces*, or an excess, and pays so much *per* verge, besides the duty of *sortie*, or exportation, (as they call it), for the 50 verges.

Those that make brandy, seldom or never put it in small barrels, or tierces except it be designed for some particular places in America, or elsewhere, where those small measures are advantageously sold to people, who, perhaps would not be able to buy a pipe at a time; for a piece of brandy that contains perhaps $1\frac{1}{2}$ of an ordinary piece, costs but very little more of freight and carriage than one that contains $\frac{1}{2}$ or $\frac{1}{3}$ less.

At Hamburg it is likewise sold at so many pounds gross, of $7\frac{1}{2}$ marks lubs *per* pound gross, or at so many rix-dollars in banco; but at Lubeck it is paid in current money, there being no bank.

At Bremen, Copenhagen, and Embden, it is also sold at so many rix-dollars; and in this last place the Hogshead is counted but 27 verges.

At London it is sold by the tun of 252 gallons; and, in short, in every country according to the custom of the country, which must always be strictly inquired into by the dealers for their government.

Of Measures for Oil of Olives.

The oil of olives is ordinarily kept in butt, or pipes, containing from 20 to 25 steckans, at 16 mingles a stekan; and there go 717 mingles, or 1434 pints of Amsterdam, to the tun of oil. They reckon at Genoa, that the barrel of oil of olives weighs $187\frac{1}{2}$ pounds nett of their weights, which make 125 pounds of Amsterdam; and 14 barrels make 717 mingles of the said place, or thereabout.

At Leghorn, the barrel of oil of olives weighs 85 pounds of their weight, which is a little more than 59 pounds of Amsterdam.

In Provence they ſell it by the meaſure of that country, called *millerole*, containing 66 Paris pints, which make about 100 pints of Amſterdam; and, in ſome places of that country, and of Lower Languedoc they put it in certain veſſels made of goat-ſkins, as they do the wine.

In Spain and Portugal it is put in butts and pipes, to be carried over ſeas, and ſometimes in great earthen veſſels called *jars*.

Of Measures for Fish Oil.

Coarſe Fiſh oil is ordinarily kept in Barrels, containing from 15 to 20 ſteckans each.

Of Measures for honey.

Honey is kept in many different ſorts of veſſels of wood and earth, and ſold in ſome places by meaſure, and in other places by weight.

At Amſterdam they ſell it at ſo many pounds groſs *per* tun, conſiſting of 6 tierces or aams, or by ſo many florins the barrel, or the 100 weight. The Bourdeaux and Bayonne honey is ſold at Amſterdam from 30 to 40*l.* groſs the tun.

Of Round Measures for Grain, &c.

As the great diverſity of meaſures of capacity renders it very troubleſome for merchants to calculate the quantities thereof, it will be very neceſſary to give an account of thoſe that are uſed in the principal places of Europe for trade.

The laſt is of ſeveral ſorts, but all comprehended in theſe two, *viz.* the ſea laſt, and that uſed by land.

A laſt is reckoned at ſea, both with regard to meaſure and weight, according to the nature of the goods

In meaſure, there are allowed to a laſt of goods 2 tuns, or 8 hogſheads of wine, 5 pieces of brandy, or prunes, 12 barrels of herrings or peaſe, 13 barrels of pitch, 4 pipes or butts of oil of olives, and 7 quarters or barrels of fiſh oil.

By weight there is generally allowed to the laſt 4000lb. but, as wool is bulky, they reckon only 2000lb. to the laſt thereof, 3600lb. of almonds, and ſo likewiſe they make ſome abatements of ſeveral other ſorts of goods in proportion to their bulk.

The land laſt is not the ſame in all places, there being ſome difference introduced by cuſtom in the ſeveral countries of Europe.

Of the MEASURES of CAPACITY of AMSTERDAM and HOLLAND, &c.

The laſt of Amſterdam contains 27 muds, and each mud 4 ſcheppels.

Or otherwiſe, the laſt of Amſterdam contains 36 ſacks and the ſack 3 ſcheppels.

So that the mud is $\frac{1}{3}$ of the ſcheppel, and the ſcheppel is only $\frac{3}{4}$ of the mud.

A laſt of wheat commonly weighs about 4200 and 4800 lb., rye between 4000 and 4200lb., and barley between 3200 and 3400 lb.

But thoſe commodities are ſo much ſubject to alteration, by their humidity, &c that there is but little certainty in their weight.

The laſt of Amſterdam makes 19 ſextiers of Paris, or 38 buſhels of Bourdeaux; and 3 laſts make 4 muds of Rouen.

The laſt of Munickendam, Edam, Purmeran, and ſeveral other places of North Holland, is reckoned equal to that of Amſterdam.

But that of Hoorn and Enchuyſen, being likewiſe towns in North Holland, is of 22 muds, or 44 ſacks, of 2 ſcheppels each; and ſo is that of Muyden, Nearden, and Weeſoop, ſmall towns in the neighbourhood of Amſterdam.

At Haerlem they reckon 38 ſacks to the laſt, their ſacks conſiſting of 3 ſcheppels, 4 of which make 1 hoedt of Rotterdam, and 14 of thoſe ſacks make 1 hoedt of Delft.

The laſt of Alkmear, in North Holland, contains 26 ſacks.

They reckon 44 ſacks to the laſt of Leyden, and 8 ſcheppels to the ſack.

The laſt of Rotterdam, Delft, and Schiedam, is compoſed of 29 ſacks, and the ſack of 3 ſcheppels, of which $10\frac{2}{3}$ make 1 hoedt; where it is to be obſerved, that the laſt of thoſe places is 2 *per cent.* more than that of Amſterdam.

At Tergow they reckon 28 ſacks to the laſt, 3 ſcheppels to the ſack, and 32 ſcheppels to the hoedt.

Of the LAST of UTRECHT.

Utrecht they reckon 25 muds, or facks, to the laſt, $10\frac{1}{2}$ of which ſacks make one hoedt of Rotterdam.

The laſt of Amersfort is compoſed of 64 ſcheppels.

That of Montfoort, Yſſelſteid, Viannen, &c. is greater than that of Rotterdam; it is compoſed of 18 muds, and the mud of two facks.

Of the LAST of FRIESLAND.

The laſt of Leenwarden, Hearlingen, and other towns of Weſt Frieſland, is compoſed of 33 muds.

And that of Groningen in Eaſt Frieſland is of the ſame meaſure.

Of the LAST of GUELDERLAND, and county of CLEVES.

The laſt of Nimeguen, Arnham, and Dreſburg, is compoſed of 22 mouvers, and the mouver of 4 ſcheppels, 8 of which mouvers make 1 hoedt of Rotterdam.

At Thiel they reckon 33 ſcheppels to the laſt.

At Burenande 68 ſcheppels.

At Haerderwick they reckon 11 muds to 10 of Amſterdam.

Of the LAST of OVER YSSEL.

The laſt of Campen is of 25 muds for corn, 9 of which make 1 hoedt of Rotterdam.

And 9 muids of Zwoll make likewiſe 1 hoedt of Rotterdam.

The laſt of Deventer contains 36 muids of 4 ſcheppels each.

Af the LAST of ZELAND.

The laſt of Middleburg is compoſed of $4\frac{1}{2}$ ſacks of 2 ſcheppels each, or a little more; and that of fluſhing, Zirickzee, the Brill, and ſome other places, is ſomewhat different from it, the ſack being there reckoned $2\frac{1}{2}$ ſcheppels.

Of the LAST of BRABANT.

The laſt of Antwerp is compoſed of 38 verteels, of which $37\frac{1}{2}$ make 1 laſt of Amſterdam.

Their verteel is compoſed of 4 mukens, and 32 verteels make the ſack for oats.

At

At Bruſſels they reckon 25 ſacks equal to the laſt of Amſterdam.

At Malines they reckon 28 verteels equal to the laſt of Amſterdam.

The laſt of Louvain is compoſed of 37 muds, and each mud of 8 halſters,

At Breda and Steenbergue the y reckon $33\frac{1}{2}$ verteels to the corn laſt, and 29 for oats; and 13 verteels make 8 ſacks, or 1 hoedt of Rotterdam.

At Bergen-op-zoom, they allow 34 verteels to the laſt of corn, and $28\frac{3}{4}$ for oats.

That of Bois-le-duc is compoſed of $20\frac{1}{2}$ movers, 8 of which make one hoedt of Amſterdam.

Of the LAST of ſeveral towns in FLANDERS.

The laſt of Ghent is compoſed of 56 halſters for corn, and of 38 for oats. Their mud is compoſed of 6 ſacks, each ſack of 2 halſters.

At Bruges, the laſt is compoſed of $17\frac{1}{2}$ hoedts for corn, and $14\frac{1}{2}$ for oats, equal to the laſt of Amſterdam.

At St. Omer's, the laſt is reckoned $22\frac{1}{2}$ raziers the razier conſiſting of 2 ſcheppels.

At Dixmude, they reckon $30\frac{1}{2}$ raziers to the laſt of wheat, and 24 for oats.

At L'Iſle, they reckon 41 raziers to the laſt of wheat, and 30 for oats.

At Gravelin. they reckon $21\frac{1}{2}$ raziers to the laſt of corn, and $18\frac{3}{4}$ for oats.

Eighteen raziers at Dunkirk are equal to one hoedt of Rotterdam

Of the LAST of LIEGE.

The laſt of Liege is compoſed of 96 ſextiers, of 8 muds each, they rekon the corn laſt of Tongrees 15 muds, and that for oats but 14.

Of the Laſt of GREAT BRITAIN and IRELAND.

The laſt of London conſiſts of $10\frac{1}{2}$ quarters, or barrels, compoſed of 8 buſhels each, and the buſhel of 4 gallons.

The buſhel weighs between 56 and 60lb. and 10 buſhels of England make about 1 laſt of Amſterdam.

In Scotland they reckon 38 buſhels to the laſt, and 18 lcs to the buſhel; and in Ireland the ſame thing.

Of

Of the Last of Dantzick.

At Dantzick they reckon 36 ſcheppels to the laſt, which is equal to 58 ſcheppels of Amſterdam.

They likewiſe reckon 16 ſchippondts to the laſt, and 340 lb. to the ſchippondt, which makes 5440 lb. to the laſt; but they give only 15 ſchippondts, or 5100 lb. weight, the laſt of oats.

They likewiſe divide their laſt at Dantzick into 16 ſextiers, meaſure of Paris, or 20 buſhels of Bourdeaux.

They buy and ſell their corn at Dantzic, as every other thing, by Poliſh florins and groſs.

Of the Last of Riga.

At Riga they reckon 46 loopen to be equal to the laſt of Amſterdam; and they buy and ſell it by rix-dollars of 3 florins, or 90 Poliſh groſs.

Of the Last of Koningsberg.

Six laſts of that place are equal to 7 of Amſterdam.

Of the Last of Copenhagen.

They have there ſeveral laſts, which differ from one another conſiderably, according to the different ſorts of grain, or other commodities that are meaſured by them. Richard makes mention of three ſeveral ſorts of laſts uſual in Copenhagen, *viz.* of 42 barrels, of 80 ſcheppels. and of 96 ſcheppels.

Of the Last of Stockholm.

At Stockholm they reckon 23 barrels to the laſt.

Of the Last of Hamburg, Bremen, and Embden.

The laſt of Hamburg conſiſts of 90 ſcheppels.

At Bremen they reckon 40 ſcheppels to the laſt; and 8 laſts of Bremen have held out to 7 laſts, 18 muds, and 1 ſcheppel at Amſterdam.

At Embden they reckon 15½ barrels to the laſt.

Of the Muid, &c. of France.

The principal meaſure made uſe of for grain, &c. at Paris. and moſt other places of the kingdom, is called *muid*.

The

The muid contains 12 ſextiers, and the ſextier 12 buſhels.

The ſextier of good wheat weighs between 244 and 248 lb. marc weight.

They divide the ſextier of oats into 24 buſhels, which again are ſubdivided into ſeveral ſmaller meaſures.

Nineteen ſextiers of Paris are reckoned equal to 1 laſt of Amſterdam.

The muid of Rouen contains 12 ſextiers which are equal to 14 of Paris: it ought to weigh about 3360 lb. marc weight and makes 28 buſhels of Bourdeaux.

Four muids of Rouen are reckoned equal to 3 laſts of Amſterdam,

The ſextier of corn weighs 210 lb. weight of Rouen, and is divided into two mines, and the mine into 4 buſhels.

The muid of Orleans ought to weigh 600 lb. and is compoſed of 12 mines, equal to 21 ſextiers, of Paris, or 5 buſhels of Bourdeaux.

The meaſure made uſe of at Lyons, called *aſnee*, is divided into 6 buſhels, equal to $1\frac{1}{3}$ ſextier, meaſure of Paris, or $2\frac{1}{3}$ buſhels of Bourdeaux.

Eight buſhels of Rouen make one ſextier of Paris, and 2 buſhels of Bourdeaux.

The aſnèe of Macon makes $1\frac{2}{3}$ ſextier of Paris, or $3\frac{1}{3}$ buſhels of Bourdeaux.

The 5 buſhels of Avignon make 3 ſextiers of Paris, and 6 buſhels of Bourdeaux.

The ſextier of Montpelier is compoſed of 2 emines, and the emine of 2 quarters. The ſextier, weighing between 90 and 95 lb. weight of that town, being between 75 and 80 lb. marc weight; ſo that 100 ſextiers make one laſt 22 muds of Amſterdam.

The ſextier of Caſtres is compoſed of 2 emines, and the emine of 16 buſhels. The ſextier weighs about 200 lb. weight of that place, which is about 170 lb. marc weight; ſo that it may be reckoned that 1001 ſextiers of Caſtres make 4 laſts of Amſterdam.

The ſextier of Abbeville is compoſed of 16 buſhels, and is equal to that of Paris.

The ſextier of Amiens weighs from 50 to 52 lb. and 5 ſextiers.

The ſextier of Bologne weighs 270 lb. ſmall weight; and 8 ſextiers of that place render 5 of Paris.

The ſextier of Calais weighs 260 lb. and 12 of them render 13 of Paris.

Which

Which sextier of Paris renders

	St. Valery	1	sextier.
	Dieppe	1 8	mines.
	Havre de Grace	$5\frac{1}{4}$	bushels,
	Amboise	14	bushels.
	Saumur,	1	bushel,
	Tours	14	bushels,
	Blois	20	bushels.
	Aubeterre	5	bushels.
	Barbesieux	5	bushels.
	Periguex	5	bushels.

The sextier of Arles weighs only 93 lb. marc weight, and the load is 360 lb. weight of that country.

The load, of Beaucare is 2 *per cent*. greater than that of Arles.

The load of Marseilles is composed of four emines, and weighs 300 lb. weight of Marseilles, or thereabout, which makes 243 lb. marc weight; 100 lb. of which make $123\frac{1}{2}$ lb. weight of Marseilles; so that the emine weighs 75 lb. weight of Marseilles.

The load of St. Giles's is 18 or 20 *per cent*. greater than that of Arles.

The load of Tarscon is 2 *per cent* less than that of Arles.

The load of Toulon is composed of 3 sextiers of that place, and the sextier contains 11 emine, 3 of which make 2 sextiers of Paris; or otherwise, they, reckon that the bushel weighs 31 lb. and that $7\frac{3}{4}$ bushels make one sextier of Paris.

The tun of Auray in Britanny is reckoned 2200 lb.

That of Audierne 2300 lb.

That of Brest is 2240 lb.

That of Hennebon 2950 lb.

Port Lewis the same.

Quinpercorentin the same.

The tun of Nantz is composed of 10 sextiers, and the sextier of 16 bushels: it weighs between 2200 and 2250 lb. the measure being heaped, and 18 or 20 *per cent*. less, if otherwise.

The tun of Rennes weighs 2400 lb.

That of St Malo the same:

The tun of Brieux 2600 lb.

That of Rochelle and Maron 42 bushels.

Of

Of Spain.

At Seville they reckon 4 cashies to a last, each cashy consisting of 12 anegras.

The fanegue of Cadiz weighs $93\frac{3}{4}$lb. weight of Marseilles, $3\frac{1}{4}$lb. of which make the load of 300lb. weight of Marseilles aforesaid, or 243lb. marc weight.

Of Portugal.

At Lisbon they reckon 4 alguiers to the fanegue, 15 fanegues to the muid, and 4 muids to the last of Amsterdam.

Of Italy.

Grain is sold at Genoa by the mine.

Two sacks of wheat, at Leghorn, make 288lb. weight of Marseilles.

Corn is sold at Venice by the sextier, or staro which is the ordinary measure, 2 of which make a load of Marseilles.

Of the chief Measure of Constantinople, and of the East Indies in general.

There being but about 3 *per cent.* difference betwixt the aunes of Amsterdam and picos of Constantinople, 100 aunes of Amsterdam make 103 picos of Constantinople; 100 picos of Constantinople make 97 aunes of Amsterdam.

Measures of Fort St. George or Madras.

Grain Measures.

1 measure weighs about	- -	2 lb. 10 oz.	Avoir.
8 ditto is 1 mercal	- -	21	-
3200 ditto is 400 ditto, or 1 garse		8400	-

1 Madras roupee weighs 7 dwt. 11 gr. Troy, and is better than English standard 14 dwts. 10 gr. in 1 lb.: it is country-touch $9\frac{7}{8}$, China-touch $98\frac{3}{4}$.

Liquid and Dry Measures.

1 measure is equal to $1\frac{1}{2}$ pint English of 423 cubic inches.

8 ditto are equal to 1 mercal of 3384 cubic inches.

400 mercals, are equal to 1 garse of 1,353,600 cubic inhes.

1 covid is equal to $18\frac{6}{10}$ inches.

N. B. One measure weighs about 2 lb. 8 oz. Avoirdupoise.
Eight ditto weigh about 21 lb. or 22 lb.

3200 ditto is 400 mercals, or 1 game, which weighs 8400 lb. which is $3\frac{3}{4}$ tuns, or 100 Bengal baazar maunds of 82 lb. 2 oz. 2 dr. each.

BENGAL MEASURES.

One measure is five seer.
Eight ditto are forty seer.
The covid (in cloth measure) is nine inches.

OF MALACCA MEASURES.

At Malacca quoing is 3200 chupas, or 800 cautins, equal to 5000 Dutch pounds, or 5475 lb. English, or canton peculs, (according to the Dutch calculation of 125 lb. to a pecul), 40 peculs.

A last is 2000 chupas, 500 cautins, 3000 Dutch pounds, 24 peculs 3285 lb. English.

ANJENGO MEASURE.

One Anjengo covid is 18 inches English.

CALLICUTT and TELLICHERRY MEASURE.

One covid is eighten inches English; and the Callicutt guz, made use of in measuring timber, is equal to $28\frac{2}{10}$ inches English.

They likewise sometimes at Callicutt, measure their timber by the covid and borrebl; twelve borrebls is one covid when the timber is sawed, and 24 borrebls is one covid when unsawed: the price generally is one Callicutt fanam *per* solid covid.

CARWAR MEASURE.

One covid is eighteen inches English.

SURAT MEASURES.

Are the larger and lesser covid *viz.*
One covid of 36 inches, and one covid of 27 inches.

By the latter all things are sold, except broad cloth, velvet and satin, which are sold by the large covid, or English yard.

GOMBROON LONG MEASURE.

93 guz are equal to 100 yards English.

MOCHA

Mocha Measures.

Rice and other grain are ſold by the kalla and tomand; forty kallas is one tomand, and weighs about 165lb. but the governor's cuſtom (of half a kalla *per* tomand upon all grain ſold) being deducted, and the intolerable cheat in the meaſuring, together with the pilferage from the water-ſide home, being allowed for, the Bengal maund will not come out above nineteen kallas; whereas one bag, or Bengal maund, ought to hold out more than a tomand; but for the foregoing reaſons, two Bengal maunds ſeldom come out above thirty-eight kallas, and rarely that.

Oil is ſold by the kudda, noosfia, and vakia.

Sixteeen vakia's is one noosfia.

Four noosfias, or meaſures one cuddy poiſe, about 18 lb.

Of late years the price has been from three to five noosfias *per* Mocha dollar; and computing the dupper of two Bengal factory maunds to hold out about 67 or 68 meaſures each, at which rate, the noosfia, or meaſure, weighs about $2\frac{1}{4}$.

Cotton is ſold by the hearf, and nine hearfs is $11\frac{1}{2}$ Mocha dollars; it generally ſells from 30 to 40 hearfs *per* bahar.

Long Measure.

The guz is twenty-five inches Engliſh.

The covid is nineteen inches Engliſh.

CHINA.

Canton Measure.

Ten punts are one covid in piece goods, equal to $14\frac{5}{8}$ inches.—Thus far from Poſtlethwayt's dictionary.

ANTIENT MEASURES of CAPACITY.

The Jews divided their Homer thus:

$1\frac{1}{3}$	Caphs	=	1 Log
4	Logs	=	1 Cab
3	Cabs	=	1 Hin
2	Hins	=	1 Scah
3	Scahs	=	1 Ephah
10	Ephahs	=	1 Homer.

The ephah, in dry meaſure, is 3 pecks, 3 pints, 12.4 ſolid inches; and in wine meaſure it is 4 gals. 4 pints, and 15 ſolid inches. The other meaſures are in proportion.

Their Measures of Length, were

				F.	I.
24	finger-breadths, or 6 hand-breadths	=	1 Cubit	1	$7\frac{8}{9}$
2	Cubits or 4 ſpans	=	1 Holy cubit		
4	Cubits	=	1 Fathom		
$6\frac{1}{6}$	Cubits	=	1 Rood		
80	Cubits	=	1 Schænus		
400	Cubits	=	1 Furlong		
5	Furlongs	=	1 Sabbath-day's journey.		

ROMAN MEASURES of CAPACITY.

4	Cochlearii	=	1 Cyathus
$1\frac{1}{2}$	Cyathus	=	1 Autabulum
2	Autabula	=	1 Hemina
2	Heminæ	=	1 Sextarius
6	Sextarii	=	1 Congius
4	Congii	=	1 Urna
4	Urnæ	=	1 Modius
2	Urnæ	=	1 Amphora
$1\frac{1}{2}$	Amphora	=	1 Cadus
2	Ditto	=	1 Midimnus
10	Midimni	=	1 Culcus

The amphora was a Roman cubic foot, and contained $\frac{18}{23}$ of an Engliſh buſhel nearly. The other meaſures were in proportion.

The Roman Long Measures.

4	Digits	=	1 Palmus
3	Palmi	=	1 Spithama
4	Ditto	=	1 Pes
6	Ditto	=	1 Cubitus
$2\frac{1}{2}$	Pedes	=	1 Paſſus ſimplex
5	Ditto	=	1 Ditto duplex
125	Paſſus	=	1 Stadium
8	Stadia	=	1 Milliare

The ſtadium meaſured 625 Roman feet, or $208\frac{2}{3}$ yards conſequently the Roman mile meaſured $1666\frac{2}{3}$ yards.

6. Time is a mode of duration, marked and aſcertained by certain unerring periods and meaſures, whereof the apparent motion and revolution of the ſun ſeems to be the principal. Hence the interval of time elapſed between the centre of the ſun's appearance on the meridian, and its return after one revolution to the ſame meridian again, hath been concluded on by all nations to be one day. Again, from the inſtant that the ſun is in the vernal equinox, or firſt degree of Aries, till it revolve round the ecliptic to the ſame point again, hath been found, from repeated obſervations to contain 365 days, and near $\frac{1}{4}$, and the time of this revolution is called a *tropical year*; which as it did not amount to an exact number of entire days, but the fraction in four years would come little ſhort of a day; therefore every fourth year called *biſſextile*, or leap year was made to conſiſt of 366 days, and the common year of 365 days.

The year being thus eſtabliſhed was divided as follows:

Seconds
60= 1 minute.
3600= 60= 1 hour.
86400= 1440= 24= 1 day. *h. min. ſec.*
31556937=525949=8765=365 + 5+48+57=1 trop. year.

In Almanacks the year is divided into 12 calendar months, the names of which, and days they reſpectively contain, are immediately ſubjoined.

Months.	*days.*	*Months.*	*days.*	*Months.*	*days.*
January,	31	May,	31	September,	30
February,	28	June,	30	October,	31
In leap year,	29	July,	31	November,	30
March,	31	Auguſt,	31	December,	31
April,	30				

For ſome particular buſineſs, ſuch as payment of wages in the royal navy, they uſe the following table:

7 days=1 week, 4 weeks=1 month, and 13 months=1 year.

CHAP.

CHAP. VII.

ADDITION OF APPLICATE NUMBERS.

RULE.

WHEN the numbers to be added are of one denomination they muſt be placed and added as before: but when the denominations are different, like, or homogeneal denominations, muſt ſtand in one column; ſo that there muſt be as many columns as there are denominations given, decreaſing from the left hand to the right, as in the ſubſequent examples. Then, beginning with the loweſt denomination, find its ſum as in whole numbers, out of which carry to be added with the next column, the units belonging thereto, and note what remains in its proper place; proceed through the whole in this manner, till you come to the integers, or higheſt place, which are added as before.

EXAMPLES IN MONEY.

L.	*s.*	*d.*	
57456	15	$6\frac{1}{2}$	
6478	19	$7\frac{3}{4}$	
5745	17	$11\frac{1}{2}$	
6785	14	$10\frac{1}{4}$	
598	11	$11\frac{1}{2}$	
678	10	$10\frac{1}{2}$	
57	11	$10\frac{1}{2}$	
98	14	$9\frac{3}{4}$	
5	0	$8\frac{1}{2}$	
6	9	$0\frac{3}{4}$	
7	11	$9\frac{1}{2}$	
77919	19	1	upwards
77919	19	1	downwards

I am indebted as follows; to how much will it amount.

	L.	*s.*	*d.*
To A,	74568	19	$11\frac{1}{2}$
To B,	54789	18	$10\frac{3}{4}$
To C,	4900	17	$11\frac{1}{2}$
To D,	578	18	$6\frac{3}{4}$
To E.	489	14	$7\frac{1}{2}$
To F.	584	15	$9\frac{3}{4}$
To G.	674	11	$8\frac{1}{2}$
To H.	495	0	$9\frac{1}{2}$
To I.	55	0	$0\frac{1}{2}$

ILLUSTRA-

ILLUSTRATION.

In the place of farthings expressed by the fractions on the right hand, in which ½ is reckoned 2, I find 24, which is just 6*d.*; as there is nothing over to be noted, I carry the 6*d.* to the column of pence, in which, including the 6*d.* I find 97 pence, or 8*s.* 1*d.* whereof the penny falls to be noted down in the column of pence, and the 8*s.* carried to be added in with its proper column; in the units place of the column of shillings, the 8*s.* included, I find 49; wherefore, as in integers, I note 9, and carry 4 to be added with the 10's place, in which I find 13 tens=6 twenties, and 1 ten, which is noted before the 9, and both together make 19*s.*; the *L.*6 is carried to be added in with the units place of the pounds, which are added as integers.

OBSERVATION.

1. If the reason of addition of integers hath been properly attended to, the reason of the last operation will be pretty evident. For since 12 pence is equal to 1 shilling, it is plain that 97 pence is equal to 8 shillings and 1 penny; wherefore, as it would be not only inconvenient, but really absurd, to write shillings in the place of pence, no more falls to be noted in the place of pence, but the penny which is over the shillings, being truly a part of the next column, *&c.*

2. From the addition of the last example, it will appear very necessary that the foregoing tables be committed to memory, otherwise it will be impossible to add at all.

3. It will be found very convenient, in adding those denominations, in whose units place you cannot stop by ten, as you did in the place of shillings of the last example, to make a table of the nature of those subjoined, which is effected by multiplying the number in question by 2, 3, 4, 5, *&c.* and commit these several products to memory, especially in such cases as more frequently occur in practice.

4. Though the method of performing addition is perhaps as easily discovered as any other rule in arithmetic; yet to add with accuracy, and at the same time with dispatch, requires a considerable practice: I would therefore advise the young arithmetician, to take frequent exercises by himself of this kind, beginning at first with but a few lines, and increasing that number as he becomes more expert. He should at

first

first add slowly figure by figure, and repeat the same column again and again, till he can take in 2, 3, or 4 figures at once; and by thus accustoming himself to addition he will be able to perform in a few minutes, with absolute certainty, what would otherwise take him up for hours.

TABLE of grains Troy.

Grains.		*dwt.*
24	=	1
48	=	2
72	=	3
96	=	4
120	=	5
144	=	6
168	=	7
192	=	8
216	=	9
240	=	10
264	=	11
288	=	12

TABLE of pounds Avoirdupoise.

Pounds.		*quarters.*
28	=	1
56	=	2
84	=	3
112	=	4
140	=	5
168	=	6
196	=	7
224	=	8
252	=	9
280	=	10
308	=	11
336	=	12
364	=	13

The use of these tables is obvious.

I shall now give some examples of weights and measures. Those in which there may appear no difficulty, shall be left for the learner's practice; such as require illustration shall be added.

Troy weight

Pounds.	*oz.*	*dwt.*	*gr.*
472	11	19	22
534	10	14	21
647	11	18	21
348	10	17	18
246	11	19	12
347	11	13	19
618	5	15	17
947	9	17	11
64	8	8	9
9	7	11	15
5	4	10	16

Dutch weight.

Stones.	*lb.*	*oz.*	*dr.*	*gr.*
475	15	14	13	34
568	14	13	15	23
647	13	12	11	32
954	12	11	13	31
876	9	14	15	29
678	10	11	12	28
578	11	10	13	27
485	14	13	15	24
657	11	11	7	28
6	4	0	6	0
5	9	9	0	19
5937	1	13	15	25

Apothe-

Apothecaries Weight.

Pounds	℥	ʒ	℈	*gr.*
57	11	7	2	19
66	10	4	1	18
57	8	6	2	17
8	9	7	0	5
9	11	4	1	18
8	10	0	2	0
5	11	5	1	13
0	6	0	2	0
9	3	4	1	16
5	2	2	2	12
3	1	3	1	15

ILLUSTRATION.

In the example of Dutch weight, I find the column of grains, whereof 36 = 1 drop, the ſum of 275; wherefore, diſcovering at once from my memory, or a mental diviſion, that 252 grains = 7 drops, the remaining 23 is noted down. and 7 carried to be added in with the drops in the next column, &c.

Note, One that is not much verſant in addition, had better add the denominations, conſiſting of two places, at twice, till he can do that very quickly; a little practice will enable him afterwards to add up two places of any denomination at once with the greateſt eaſe.

Avoirdupoiſe weight.

Tuns.	*cwt.*	*qu.*	*lbs.*
8745	19	2	27
4856	18	3	26
5479	14	1	25
3568	17	2	24
594	16	1	23
55	11	2	21

Wool weight.

Laſts.	*ſa.*	*w.*	*t.*	*ſto.*	*c.*	*lbs.*
87	11	1	$6\frac{1}{4}$	1	1	6
43	5	1	$3\frac{1}{2}$	1	1	4
6	4	1	$2\frac{1}{4}$	1	1	3
8	6	1	$3\frac{1}{2}$	1	1	5
7	2	1	$5\frac{1}{2}$	1	1	3
12	0	0	0	0	4	4
165	8	0	$5\frac{1}{2}$	1	0	4

Cloth measure.

Yds.	qrs	nls.	parts.
45	3	3	15
30	2	1	12
67	1	2	13
8	3	1	14
9	2	2	11
7	2	3	12
8	1	1	10
9	2	0	9

English square measure.

Acres.	r.	p.	yds.	feet.	inch.
373	3	37	$27\frac{1}{4}$	6	115
485	2	38	$22\frac{1}{2}$	7	116
574	2	19	29	8	114
648	1	18	$18\frac{1}{2}$	5	125
741	2	17	$19\frac{3}{4}$	4	130
874	3	14	$24\frac{1}{2}$	3	134
878	1	18	30	5	116
6	3	17	15	6	117
4583	1	24	10	5	103

Note, In the above example of square measure, I find the sum of square yards, including what I carried, to be $191\frac{1}{2}$, I then consider that $6\times30=180+\frac{6}{4}=181\frac{1}{2}$, and the remainder easily occurs to be 10.

Scots square measure.

Acre.	rood.	fall.	ell.
42	1	38	10
57	3	39	35
43	2	27	24
8	3	15	27
65	2	24	17
37	3	31	32
45	2	15	18

Long measure.

Miles.	fur.	yds.	feet.	inch.
3467	5	219	3	10
4567	7	184	1	11
5678	6	62	2	8
78967	4	9	0	9
56789	3	84	2	11
24608	2	147	1	10
35791	1	210	2	6
209871	0	80	0	5

In the example of long measure, the perches are neglected; and there is no other intermediate deno mination betwixt yards and furlongs, I carry at 220.

Wine measure.

Tun.	*hhd.*	*gall.*	*qu.*	*pints.*
436	3	61	2	1
678	2	61	3	0
569	1	48	1	1
456	0	29	2	1
789	1	36	2	0
987	2	54	1	1
672	3	46	3	1
4591	1	24	1	1

Ale and beer measure

Hhd.	*bar.*	*kil.*	*fir.*	*gal.*
176	1	1	1	$8\frac{1}{4}$
374	$1\frac{6}{4}$	1	1	$7\frac{1}{4}$
842	1	0	1	6
374	$1\frac{1}{4}$	1	0	$5\frac{3}{4}$
516	$0\frac{1}{2}$	1	0	$5\frac{1}{2}$
637	1	1	1	$6\frac{3}{4}$
591	1	1	1	8

Scots dry measure.

Ch.	*b.*	*f.*	*p.*	*l.*
875	15	2	1	1
43	14	3	3	3
87	13	2	2	2
6	15	3	2	2
67	14	2	3	2

English dry measure.

Q.	*b.*	*p.*	*g.*
875	7	3	1
43	4	2	1
67	5	3	1
54	4	2	1
475	5	3	1

CHAP. VIII.

SUBTRACTION of APPLICATE NUMBERS.

RULE.

PLACE the numbers or denominations, homogeneal under homegeneal, and borrow according to the division of the integer, as illustrated in some of the following examples.

Money.

	L	*s.*	*d.*
From	54	13	$11\frac{1}{4}$
Take	35	15	$8\frac{1}{2}$
Rests	18	18	$2\frac{3}{4}$

Troy weight.

lbs.	*oz.*	*dwt.*	*gr.*
87	7	13	21
43	10	15	17
43	08	18	4

Apothecaries weight.

lbs.	℥	ʒ	℈	*gr.*
83	7	4	1	13
42	5	7	3	18
41	1	4	1	15

ILLUSTRATION.

In the example of money, I cannot take $\frac{1}{2}$ from $\frac{1}{4}$, and therefore I take it from an unit of the next higher denomination, and to the remainder add the given $\frac{1}{4}$; thus 4 farthings$-2+1=\frac{3}{4}$. I replace the unit I had thus borrowed, by adding to it 8*d*, whence I had taken it. And indeed it would have anſwered the end to have taken the difference betwixt $8\frac{1}{2}$ and $11\frac{1}{4}d$ at once, if it could upon all occaſions have been recommended to practice, as it would have brought out the ſame remainder.

Subtraction is ſo eaſy an operation, and the memory is ſo little burdened with it, that a farther illuſtration would be needleſs, and and therefore I ſhall only ſubjoin a few examples for practice,

Dry measure

Laſt.	*wey.*	*qu.*	*b.*	*p.*
87	1	2	4	2
43	1	3	5	3

Long meaſure.

M.	*f.*	*p.*	*y.*	*feet*
47	5	34	$3\frac{1}{2}$	1
13	6	37	$4\frac{1}{4}$	2

Cloth meaſure

Yds.	*qrs.*	*nls.*
57	1	0
14	3	1

Avoirdupoiſe weight.

Tun.	*cwt.*	*qrs.*	*lbs.*
75	7	3	17
59	14	3	19

Wine meaſure.

Tuns.	*p.*	*hhds.*	*gal.*
75	1	0	35
68	1	1	50

Ale meaſure.

Bar.	*f.*	*gal.*	*q.*	*p.*
43	1	5	2	0
29	1	7	3	1

Yarn

Sp.	*ha.*	*hee.*	*c.*	*th.*
572	1	1	1	100
69	1	5	1	115

Time

Y.	*d.*	*h.*	*m.*	*ſ.*
7415	199	14	50	40
897	$270\frac{1}{4}$	19	50	52

Queſtions for practice in addition and ſubtraction.

1 A merchant, in balancing his books, finds he hath in ready money, *L.*456:17; in goods, *L.*1749:19 6; his ſtock

ſtock in a company trade was L. 199 : 19 : 6½ due him in open accounts, L. 2977 : 19 : 7¾; in bills, L. 647; 17; in ſhips and houſes, L. 1976 : 14 : 7½ and in conſignments, L. 479 : 19 : 7. He owes to A, L. 1456 : 18 : 7½ to B, L. 99 : 19 : 11; to C, L. 497 : 17 : 10; and to the bank, L. 490. What is his nett ſtock?

	L.	s.	d.		L.	s.	d.
Caſh,	456	17	0	He owed to A.	1456	18	7½
Goods,	1749	19	6	To B,	99	19	11
Company,	199	19	6½	To C,	497	17	10
Accounts,	2977	19	7¾	To the bank,	490	0	0
Bills.	647	16	0				
Ships, &c.	1976	14	7½	Sum of his debt,	2544	16	4½
Conſign.	479	19	7				
Groſs ſtock,	8489	5	10¾				
Sum of debt,	2554	16	4½				
Nett ſtock.	5944	9	6½ Anſwer.				

2. A merchant, hath a bill to pay of L. 500, for which he had prepared in caſh, L. 197 : 19; he hath a bill on Edinburgh for L. 120; for how much muſt he draw on the bank to retire the bill of L. 500?

Anſwer L. 182 : 1

3. A farmer paid of yearly rent for his poſſeſſion L. 156 17s. 8d.; at the expiration of three years, when he was called to ſettle accounts with the landlord, he could produce receipts only for L. 376 : 19 : 7½. How much muſt he pay to even the account?

Anſwer, L. 93 : 13 : 4½.

4. Bought 8 hogſheads of raiſins, each weighing groſs 5 *cwt.* 1 *quarter*, and 11 *pounds*: upon each hogſhead whereof I am allowed a deduction of 3 *quarters*, and 21 *pounds*, What will be the nett weight?

Anſwer, 35 *cwt.* 1 *quarter*, 4 *pounds*.

5. A merchant ſent his clerk to a fair, where he bought linen to the amount of L. 105 : 12 : 11; ſtockings to the amount of L. 184 : 16 : 11; he recovered of accounts due the merchant to the amount, of L. 64 : 10; and got payment of a bill for L. 139 : 19; he paid ſome few demands, amounting in all to L. 19 : 19 : 11; his account of petty charges came to L. 1 : 14 6; and he gave back to his maſter, L. 27 : 11 : 10. How much money had he got from the merchant before he ſet out?

Anſwer,

Anſwer, L. 135 : 71.

6. A caſtle was built in the year 1459; how old is it in the year 1787?

7. Received from Jamaica 103 *tuns*, 13 *cwt.* of logwood, by the Happy, Janet, of which I ſold to A, 15 *tnns*, 10 *cwt.* 3 *qrs.* 17 *lb.*; to B, the double of what I ſold to A; and to C, as much, as I had ſold to A; and B together. How much have I on hand?

8. A father hath bequeathed his whole fortune to his ſon A and his daughter B, in all L.8745 : 18 : 8 with particular orders that the ſon ſhould L. 1821 : 6 : 8 more than the daughter. The true dividend is required.

	8745	18	8	
	1821	6	8	
2	10567	5	4	
	5283	12	8	to the ſon,
	3462	6	0	to the daughter,
	1821	6	8	Proof

CHAP.

MULTIPLICATION. of APPLICATE NUMBERS.

RULE.

WHEN the multiplicand conſiſts of different denominations, beginning the multiplication at the right hand, carry as in addition, one from each denomination to another, for as many as make an unit of the next ſuperior order, and place the remainder under its proper denomination. A few examples will render this extremely plain.

Queſt. 1. What coſt 8 pieces of broad cloth, at L 5 : 17 : 8 *per* piece?

L.	5	17	8
			8
L.	47	1	4 Anſwer.

2. What

2. What coſt 72 bags of cotton, at *L* 7: 14: 8 *per* bag?

L. 7	14	8	
		8	
L. 61	17	4	
		9	
L. 556	16	0	Anſwer.

3. What coſt 34 pieces of luteſtrings, at *L.* 9: 18: 8 *per* piece?

L. 9	18	8 × 2	
		8	
79	9	4	
		4	
317	17	4	price of 32 pieces.
19	17	4	price of 2 pieces.
337	14	8	price of 34 pieces. Anſ.

4. What coſt 76 *cwt.* of ſhip-biſcuit, at 13*s.* 6*d. per cwt.*?

	s.	*d.*	
	13	6 × 4	
		12	
L. 8	2	0	price of 12
		6	
48	12	0	price of 6×12=72
2	14	0	price of 4× 1= 4
51	6	0	price of 76 Anſwer.

5. Sold

5. Sold 174 ingots of silver, each ingot weighing 15 *lb.* 11 *oz.* 19 *dwt.* 21 *gr.* what is the weight of the whole?

lb.	*oz.*	*dwt.*	*gr.*		
15	11	19	21		
			10		
159	11	18	18	weight of 10.	
			10		
1599	11	7	12	ditto of	10×10=100
1119	11	11	6	ditto of	7×10= 70
63	11	19	12	ditto of	4× 1= 4
2787	10	18	6	ditto of	174 Answer.

6. Bought 574 pounds of tobacco, at $7\frac{3}{4}$ *per* pound; what cost the whole?

L. 0	0	$7\frac{3}{4}$		
		10		
0	6	$5\frac{1}{2}$	value of 10 pounds.	
		10		
3	4	7	ditto of	10×10=100
		5		
16	2	11	ditto of	5×100=500
2	5	$2\frac{1}{2}$	ditto of	7× 10= 70
0	2	7	ditto of	4× 1= 4
L. 18	10	$8\frac{1}{2}$	ditto of	574 Answer.

These examples are sufficient for exhibiting all the necessary varieties in multiplication of mixed numbers, the more especially as the learner will find, in the rule of practice, methods that are in general much more expeditious, and less burthensome to the memory, for resolving all questions of this kind; though in some cases; where a single multiplication, or perhaps two, are only necessary, this may be used with great propriety.

CHAP.

CHAP. X.

DIVISION of APPLICATE NUMBERS.

RULE.

IN dividing different denominations, the remainder of the integral part must be brought to the quality of the next inferior denomination; and, if any of that denomination was given it must be added to the product: then find how oft the divisor is contained therein, and the quotient will be of that denomination: if any thing still remain, proceed in the same way, as illustrated in the following examples.

Quest. 1. *L.*34 : 16 is to be divided among 5 men equally.—What will fall to each?

$$
\begin{array}{l}
5\;)\;34:16\;(\;6:19:2\tfrac{2}{5} \\
\quad\;\; 30 \\
\quad\;\; \overline{\;\;\;} \\
\quad\;\; 4\times20+16=96 \\
\qquad\qquad\qquad\;\; 5 \\
\qquad\qquad\qquad\;\; \overline{\;\;\;} \\
\qquad\qquad\qquad\;\; 46 \\
\qquad\qquad\qquad\;\; \underline{45} \\
\qquad\qquad\qquad\;\; 1\times12=12 \\
\qquad\qquad\qquad\qquad\qquad\;\; \underline{10} \\
\qquad\qquad\qquad\qquad\qquad\;\;\; 2
\end{array}
$$

Note, after a little practice the last question, or any other where the divisor is small, may be expeditiously done by a mental multiplication and subtraction. When the divisor is great, the memory may be helped in the more burdensome part of the work, by using a piece of waste paper, or still better by abbreviating the terms when possible.

The last example resumed. $5\,)\,34 : 16 : 0$

$6 : 19 : 2\frac{2}{5}$

Note, When *L*.34 is divided, the remaining *L*.4 : 16 will readily occur to be $=96$*s*.; which being partially divided, quotes 19*s*. with 1 remaining $=12$*d*. of which $\frac{1}{5}= 2\frac{2}{5}$.

2. Bought 48 pieces of cloth for *L*.256 : 18; what did it cost *per* piece?

$$\begin{array}{r|rrr} 8) & 256 & 18 & 0 \\ \hline 6) & 32 & 2 & 3 \\ \hline & 5 & 7 & 0\frac{1}{2} \end{array}$$

Answer.

3. Bought 375 pieces of Irish linen, for 701 : 15 : 3; freight and other charges came to *L*.4 : 17 : 11. What did it cost *per* piece?

$$\begin{array}{r|rrr} & L.701 & 15 & 3 \\ & 4 & 17 & 11 \\ \hline 5) & 706 & 13 & 2 \\ \hline 5) & 141 & 6 & 7\frac{3}{5} \\ \hline 5) & 28 & 5 & 4 \\ \hline 3) & 5 & 13 & 0\frac{4}{5} \\ \hline & 1 & 17 & 8\frac{1}{5} \end{array}$$

Note, It will be sufficiently exact to take the quotient of the fractions that is nearest the truth; and, if you are above the just quotient at one time, be below it at another time, as in the last example.

4. If 60 gallons of water fall into a cistern that will contain 200 gallons, in the space of an hour, and by a pipe in the same cistern there run out 45 gallons in the same time; how long will it take to be full in this case?

$60-45=15)200$

Hours, 13 20 *min*, Answer

5. If

5. There is a legacy of L. 4753 : 19 to be divided among A, B, C, D and E, in ſuch a manner, that for every ſhilling E takes up, D ſhall have 2, C 3, B 4, and A 5; what will fall to each?

1+2+3+4+5=15)4753	19	0	
316	18	$7\frac{1}{5}$	E's ſhare
633	17	$2\frac{2}{5}$	D's ſh=2 E's ſh.
950	15	$9\frac{3}{5}$	C's ſhare=D+E
1267	14	$4\frac{4}{5}$	B's ſhare=C+E
1584	13	0	A's ſhare=B+E
4753	19	0	Proof

6. A gentleman on his death-bed, leaving his wife pregnant, and an eſtate of L.6666 : 13 : 4, ordered by his teſtament, that, if his wife bore a ſon, $\frac{2}{3}$ of the fortune ſhould go to that ſon, and the other $\frac{1}{3}$ to the widow; but, if ſhe bore a daughter, the widow ſhould enjoy $\frac{2}{3}$, and the daughter the remainder: ſhe had a ſon and a daughter at the ſame time. In this caſe, how will the fortune be divided?

By the teſtament the ſon was ſecured in double the widow's ſhare, and the widow in double the daughter's; therefore, the daughter's ſhare muſt be to the widow's as 1 to 2, and the widow's to the ſon's as 2 to 4.

Upon theſe principles it will be divided thus:

1+2+4=7)6666	13	4	
952	7	$7\frac{3}{7}$	the daughter's ſhare.
		2	
1904	15	$2\frac{6}{7}$	the widow's ſhare
		2	
3809	10	$5\frac{5}{7}$	the ſon's ſhare.
6666	13	4	as before.

7. A privateer takes a prize, value L. 20,000; the crew consisted of the captain, the lieutenant, the master, master's mate, surgeon, surgeon's mate, purser, 4 midshipmen, and 100 men: by the ship's regulations, the private men shared equally, a midshipman had as much again as a private man, each mate the double of a midshipman's share, the surgeon and purser drew each the double of a mate's share, the lieutenant and master had each as much as the surgeon, and purser, and the captain as much as both lieutenant and master: according to these regulations, how will the prize be divided?

100+8+8+16+32+32=196)20,000

L.10204 1 3 = 100 × - - 102 0 9¾ *per* man.
2

816 6 6 = 4 × - - 204 1 7½ to midship.
2

816 6 6 = 2 × - - 408 3 3 to each mate.
2

1632 13 0 = 2 × - - 816 6 6 to surg. &
2 purser each.

3265 6 0 = 2 × - - 1632 13 0 to lieutenant
2 master each.

3265 6 0 = 1 × - 3265 6 0 to the capt.
0 0 9 lost with the remainder.

20000 0 0 as before.

The

The Application of Multiplication and Division to square and solid measures.

Quest. 1. What is the square content of a room, 18 feet 8 inches, by 14 feet 6 inches?

2) 18'	8
	7
130	8
	2
261	4 = 18 8 × 14
9	4 = 18 8 ÷ 2
270	8 Answer.

2. What is the square content of a room, 12 feet 7 inches long, and 11 feet 5 inches broad?

3) 12	7
11	5
138	5 = 11 × 12 7
4) 4	$2\frac{1}{3}$ = 12 7 ÷ 3 for 4 inches.
1	$0\frac{7}{12}$ = 4 $2\frac{1}{3}$ ÷ 4 for 1 inch.
143	$7\frac{11}{12}$ Answer.

3. What is the solid content of a box, 5 feet 6 inches thick, 4 feet 4 inches broad, and 7 feet 3 inches long?

7	3
4	4
29	0 = 7 3 × 4
2	5 = 7 3 ÷ 3 for 4 inches.
31	5 square content.
5	6
157	1 = 31 5 × 5
15	$8\frac{1}{2}$ = 31 5 ÷ 2 for 6 inches.
172	$9\frac{1}{2}$ solid content.

4. There

4. There is a box 6 feet 6 inches long, 7 feet 9 inches broad, at one end, and 3 feet 7 inches at the other, and 4 feet 6 inches thick; what is its solid content?

7	9	one way.
3	7	the other way.
2)11	4	sum of the breadths.
5	8	mean breadths.
6	6	
34	0	
2	10	
36	10	square content.
4	6	
147	4	
18	5	
165	9	solid content.

CHAP. XI. REDUCTION.

REDUCTION converts one denomination, or species, into another, without altering the value.

RULE I.

To reduce numbers of a higher denomination to numbers of the same kind of an inferior denomination, multiply by as many of the inferior denomination as makes one of the greater.

RULE II.

To reduce numbers of a lower denomination to numbers equivalent of a higher denomination, divide by as many of the inferior as makes one of the greater.

EXAMPLES

EXAMPLES.

(1.)

Reduce *l*.760 to farthings.

```
   20
 ------
 15200 shillings.
    12
 ------
 182400 pence
      4
 ------
 729600 farthings
```

(2.)

Reduce 729600 farthings to pounds.

```
 4)729600
 --------
12)182400 pence.
 --------
20)15200 shillings.
 --------
     760 pounds
```

(3.)

In 74 lb. 11 oz. 15 dwt. Troy how many grains?

```
 74  11  15
 12
 ---
 899 ounces.
  20
 ---
 17995 dwts.
    24
 ------
 431880 gr.
```

(4.)

In 431880 grains, how many pounds Troy?

```
 4)431880
 --------
 6)107970
 --------
20)17995 dwt.
 --------
12)889   15 oz.
 --------
    74   11 15 Ans.
```

More examples of this kind of reduction would be unnecessary, as the reason and manner of the operation must be obvious.

RULE III.

To reduce one species into its equivalent of another, when the one is no even part of the other—multiply the given number by the value of an unit of the same species expressed in the lowest name mentioned in the question, and divide that product by the value of an unit of that species which is required, expressed in the same name.

Quest.

1. In L.4754 : 19, how many guineas, crowns, shillings, and sixpences, of each and equal number?

$$\begin{array}{r}
4754 \quad 19 \\
20 \\
\hline
95099 \\
2 \\
\hline
\end{array}$$

$$4^2+10+2+=\frac{155}{11}\Big)\ 190198$$

$$38039\tfrac{3}{5} \text{ abridged by } 5.$$

$$3458\tfrac{8}{55} \text{ of each species.}$$

2. If I had guineas 90 score, and crowns just 92; in place of of 30 hundred pounds, what money would be due?

$$90 \times 21 = 1890l.$$
$$92 \div 4 = \ \ 23$$

Take L. 1913 in the guineas and crowns,
From 3000

Remains 1087 due.

3. Two merchants, A and B, had been long in a company trade; A's share of the concern was to B's as 4 to 1: when circumstances rendered it necessary for them to wind up and separate, the state of their affairs was as follows: Their cash and other effects, by an inventory, amounted to *L.* 5000; bills and open accounts, in Britain, to *L.*1300; Holland was indebted to them nett proceeds of tobacco, for 7485 guilders, at $21\frac{1}{8}$*d.*; and Dunkirk in crowns 7456, at $31\frac{1}{4}$*d.*; they were due in Britain *L.* 3754, and in Hamburg 7315 marks, at 1 *s.* 7 *d.* Required their nett stock, and a partition thereof, according to each partner's original input.

They

They had effects, *per* inventory, valued at	L. 5000 0 0	
Bills and open accounts, in Britain, for	1300 0 0	
7485 guilders, at 21$\frac{1}{8}$*d.* =	658 16 8$\frac{1}{2}$	
7456 crowns, at 31$\frac{1}{4}$ =	970 16 8	
		7929 13 4$\frac{1}{2}$
They were due in Britain	3754 0 0	
In Hamburg 7315 marks, at 19*d.*	579 2 0	4333 2 0
Nett Stocks,	4+1=5)	3596 11 4$\frac{1}{2}$
	B draws	719 6 3$\frac{3}{10}$
	A draws	2877 5 1$\frac{2}{10}$

4. Quebec lies 300 geographical miles N. W. of Boston, what is the distance in French leagues?

$$\begin{array}{r} 300 \\ 5 \\ \hline 12)1500 \\ \hline 125 \end{array} \quad \text{Answer.} \qquad 5)\frac{25}{60}\left(\frac{5}{12}\right.$$

5. A gentleman carried to the bank to pay for a bill on London at par the following collection of paper and specie, for how much was the bill drawn?

37	pieces of L.	3	12	0	each.
87	do.	1	16	0	each.
174	do.	0	16	6	each.
268	do.	1	7	0	each.
837	do.	0	4	9	each.
278	do.	1	1	0	each.
125	do.	0	5	3	each.
125	notes	1	10	0	each.
26	do.	5	0	0	each. Ans. L. 1541:18.

6. It is admitted that 1000 acres measured by the English chain are nearly equal to 787 by the Scots; how many English acres will be contained in 1576 Scots?

	Acres.	r.	p.	sq. yards.
Answer	2002	2	6	$18\frac{1}{3}$

7. A traveller wants to exchange L, 676 : 19 : 3 for moidores at 27*s.* pistoles at 16*s.* 6*d.* dollars at 4*s.* 6*d.* and quarter-guineas at 5*s.* 3*d.* of each an equal number; how many may he get of each?

Answer. $254\frac{55}{213}$

8. In 97415 yards English, how many Scots ells?

Afwer $94782\frac{1}{6}$.

9. In 549 Scots pints, how many English gallons, wine measure?

Anfwer $246\frac{87}{23}$ r.

Questions of this nature might be multiplied to any length, but it ls presumed there is a sufficient variety in the foregoing for the improvement of the ingenious.

THE

UNIVERSAL ACCOUNTANT.

PART II.

OF FRACTIONS.

I. OF VULGAR FRACTIONS.

INTRODUCTION.

A VULGAR FRACTION is a part, or parts of an integer arising from division, and stands to an unit in the relation that a part doth to the whole.—Of those parts the numerator expresseth the number, as $\frac{3}{4}$ and the denominator the quality, as

Hence the denominator supposeth the integer to be divided into 4 equal parts; for instance, 1 yard into 4 quarters: and the numerator ascertaineth the number of those parts to be 3; and the fraction is accordingly read three fourths, or quarters of 1.

Since the denominator represents all the parts into which the integer is divided, and the numerator the number of those parts expressed by the fraction, it must follow, that, if the numerator be less, equal to, or greater than the denominator, the quantity represented by the fraction must be less, equal to, or greater than the integer accordingly. Hence, if the numerator is less than the denominator, the fraction is called *proper*, and represents something less than the integer, as $\frac{3}{4}$, $\frac{1}{2}$, $\frac{1}{3}$, &c.

If the numerator is equal to, or greater than the denominator, the fraction is called *improper*, and represents something equal to, or greater than the integer, as $\frac{4}{4}=1$, $\frac{5}{4}=1\frac{1}{4}$, &c.

Since an integer may be divided into any number of parts, each of these parts may be again subdivided, and each of these subdivisions again, *ad infinitum*; as a pound is divided into 20 shillings, each of these shillings into 12 pence, and each of these pence into 4 farthings. Hence, 3 farthings would be expressed fractionally $\frac{3}{4}$ of $\frac{1}{12}$ of $\frac{1}{20}$, and such fraction would be called a *compound fraction*.

Since any of the denominations, or parts of an integer, can be expressed fractionally, a fraction annexed to an integer will express the same thing as its equivalent denomination. Hence *L.* 4: 10*s.* since 10*s.* represents 10 of 20 parts of a pound, may be wrote $4\frac{10}{20}$ and so called a *mixed number*.

Observation 1. Those fractions are equal to each other, whose numerators have the same relation to their denominators, $\frac{3}{6}=\frac{4}{8}=\frac{5}{10}=\frac{6}{12}=\frac{14}{28}=\frac{1}{2}$. For as all fractions arise from remainders in division,

 when

when the divisor can no longer measure the dividend, so every fraction may be considered as the two given terms of a division, the numerator as the dividend, and denominator as the divisor: consequently, if the numerator and denominator of a fraction be either multiplied or divided both by the same number, the products or quotients will still remain in the same proportion, and the numerator of the new fraction bear the same relation to its denominator as it did in its former state.

2. Fractions having a common denominator, are greater or less as their numerators, as $\frac{4}{5}$ represents a greater part of a quantity than $\frac{3}{5}$.

3. Of fractions whose numerators are equal, that which hath the least denominator represents the greatest part, as $\frac{3}{4}$ of a yard represents 3 quarters, and $\frac{3}{16}$ only 3 nails.

4. If two fractions are equal, the numerators multiplied into each other's denominator respectively, will make the products equal.— Suppose $\frac{2}{4}=\frac{1}{2}$, then $2\times2=4$, and $4\times1=4$.

CHAP. I.

REDUCTION OF VULGAR FRACTIONS.

Prob. 1. To express a whole number fractionally.

The given integer will be the numerator, and unity the denominator: thus, $\frac{5}{1}$, $\frac{6}{1}$, *&c.*; because to divide 5 by 1, the quotient will be 5; *&c.*

Prob. 2. To reduce a mixed number to an improper fraction.

To the product of the integer and denominator multiplied add the numerator; the sum shall be the numerator of the improper fraction, whose denominator shall be that of the fraction given.

Exam. $4\frac{4}{5}=5\times4+4=\frac{24}{5}$; and $5\frac{5}{6}=5\times6+5=\frac{35}{6}$, $8\frac{8}{9}=\frac{80}{9}$, $19\frac{4}{7}=\frac{137}{7}$, $25\frac{11}{12}=\frac{311}{12}$.

Observ. The reason of this operation is evident; for the multiplication of the integer into the denominator + the numerator, expresses in the product all the parts contained in both, and the same denominator being again applied, the quality of those parts is the same.

Prob. 3. To reduce an improper fraction to a whole, or mixed number.

Divide the numerator by the denominator, and to that quotient annex the remainder, if any, with the divisor for the fractional part.

Exam. $\frac{24}{5}=4\frac{4}{5}$, and $\frac{35}{6}=5\frac{5}{6}$, $\frac{80}{9}=8\frac{8}{9}$, $\frac{137}{7}=19\frac{4}{7}$, $\frac{311}{12}=25\frac{11}{12}$.

This

This is the reverſe, and conſequently an additional proof of the former problem.

Cor. Hence it will be obvious, that, to reduce an integer to an improper fraction of an aſſigned denominator, we have only to multiply the integer into the aſſigned denominator, and the product will be the numerator required. For inſtance, to change 8 into a fraction whoſe denominator is 7, $8\times7=\frac{56}{7}$, *&c.*

Prob. 4. To reduce a compound fraction to its equivalent ſimple one.

The continual product of all the numerators will be the numerator, and the continued product of all the denominators will be the denominator required.

Ex. $\frac{3}{4}$ of $\frac{4}{5}$ of $\frac{3}{7}=\frac{3\times4\times3}{4\times5\times7}=\frac{36}{140}$, and $\frac{1}{2}$ of $\frac{3}{4}$ of $\frac{5}{8}=\frac{1\times3\times5}{2\times4\times8}=\frac{15}{64}$

$\frac{7}{8}$ of $\frac{5}{9}$ of $\frac{4}{5}=\frac{140}{360}$, $\frac{11}{12}$ of $\frac{5}{6}$ of $\frac{3}{4}=\frac{165}{288}$.

Obſervation. The continued multiplication of the numerators and denominators reſpectively, brings each to the quality of the loweſt name: for, to expreſs 9 *d.* as the fraction of a pound, it would be $\frac{9}{240}$, becauſe there are 240 pence in a pound; if we conſider it as a compound fraction, as it really is, it will be expreſſed $\frac{9}{12}$ of $\frac{1}{20}$ which, by the rule, $=\frac{9}{240}$, as before.

Cor. Hence all the known ſubdiviſions of an integer may be expreſſed in a compound or ſimple fractions at pleaſure.

A little of this proceſs may be ſaved, by exterminating equal numbers above and below the line.

As $\frac{3}{5}$. of $\frac{5}{7}$. of $\frac{7}{12}$. of $\frac{12}{25}=\frac{3}{25}$ by exterminating 5, 7 and 12.

And $\frac{4}{7}$ of $\frac{3}{4}$ of $\frac{7}{9}=\frac{3}{9}$ and $\frac{4}{9}$ of $\frac{9}{15}$ of $\frac{15}{16}=\frac{4}{16}$.

By this abreviation, the fraction is alſo reduced to lower terms.

Prob. 5. To reduce fractions having different denominators to other equivalent fractions, having a common denominator.

The continued product of each numerator into all the denominators but its own, will give correſpondent numerators, and the continued product of the denominators will give a common denominator.

Exam 1. $\frac{3}{5}$ $\frac{1}{2}$ $\frac{4}{7}$, thus $\left.\begin{matrix}3\times2\times7=42\\1\times5\times7=35\\4\times2\times5=40\end{matrix}\right\}$ Numerator.

Therefore $\frac{3}{5}=\frac{42}{70}$ $5\times2\times7=70$ Common denom.

$\frac{1}{2}=\frac{35}{70}$

$\frac{4}{7}=\frac{40}{70}$, as required

Prob. 6. To bring a fraction of a higher denomination to an equivalent fraction of a lower.

Reduce the numerator to the name required for the numerator of the new fraction, the denominator will be the ſame as before.

Exam. $\frac{5}{7}$*l.* to the fraction of a ſixpence; thus,

$$\overset{s.}{5\times20}\times\overset{6ds.}{2}=\frac{200}{7}$$

$\frac{3}{5}$ of a guinea to the fraction of a farthing, $3\times\overset{s.}{21}\times\overset{d.}{12}\times\overset{q.}{4}=\frac{3024}{5}$.

Prob. 7. To reduce the known parts of a relative unit to the equivalent fraction of that unit.

This was formerly taken notice of in the corollary of *Prob.* 4. and it is only reſumed here for farther illuſtration to thoſe who may find it ſtill neceſſary.

Reduce all the given parts to the loweſt mentioned, for a numerator, and the integer into the ſame name for a denominator.

Ex. 5*s.* 7$\frac{1}{2}$*d.* to be expreſſed fractionally, $\frac{5\times12+7\times2+1=135}{20\times12\times2=480}$

2. Reduce 15|3$\frac{3}{4}$ to an equivalent fraction.

Anſwer $\frac{735}{960}$ in loweſt terms $\frac{147}{192}$ abridging by 5.

3. Reduce 11 *oz.* 18 *dwt.* 20 *gr.* Troy to an equivalent fraction.

Anſwer, $\frac{5732}{5760}$.

4. Reduce 3 *qrs.* 14 *lbs.* 11*oz.* Avoirdupoiſe to an equivalent fraction.

Anſwer, $\frac{1579}{1792}$

Prob. 8. To reduce fractions in the known parts of the integer.

This is the converſe of the laſt problem, and hath been exemplified in diviſion, but ſtill it may not be improper to give the rule.

Multiply the numerator by the parts of the next inferior denomination, and divide the product by the denominator; the quotient ſhews the part of that denomination, and the remainder becomes a new numerator, which muſt be valued as before, &c. till the fraction is brought to the loweſt known name of the integer.

Exam.

Exam. Value $\frac{135}{480}$ *l.*	Value $\frac{7}{12}$ of *cwt.*
135	7
20	4
s. d.	*Qr. lb. oz.*
480) 2700 (5 $7\frac{1}{2}$ as above	12) 28 (2 9 $5\frac{1}{3}$
2400	24
300	4
12	28
3600	112
3360	108
240	4
4	16
960	64
960	60
0	4

Value $\frac{1579}{1792}$ *cwt.* Answer, 3 *Qrs.* 14 *lbs.* 11 *oz.*

Value $\frac{5732}{5760}$ *lb.* Troy. Answer, 11 *Oz.* 18 *dwt.* 20 *gr.*

Value $\frac{147}{192}$ *L.* Answer 15|$3\frac{3}{4}$.

Value $\frac{53}{94}$ tun. Answer, 11 *C.* 1 *q.* 3 *lb.* nearly.

Value $\frac{41}{50}$ of a year. Answer, 299 *Days.* 7 *hours.* 12 *minutes.*

CHAP.

CHAP. II.

ADDITION of VULGAR FRACTIONS.

RULE.

REDUCE all the given fractions to simple fractions of the same integer and denominator, if not so already; then the sum of the numerators with the common denominator, will be the fractional sum required, which may be reduced to a mixed number, valued or expressed in shorter terms, as seems most expedient, or as the case will admit.

EXAMPLES.

1. Add $\frac{3}{7}+\frac{4}{7}+\frac{5}{7}$. $3+4+5=\frac{12}{7}=1\frac{5}{7}$. Here 7 is a common denominator.

Add $\frac{3}{5}$, $\frac{1}{2}$, and $\frac{2}{3}$.

$$\begin{array}{r} 3\times2\times3=18 \\ 1\times5\times3=15 \\ 2\times5\times2=20 \\ \hline 53 \text{ numerator} \\ \hline 5\times2\times3=30 \text{ denominator,} \end{array} =1\tfrac{23}{30}$$

2. Add $\frac{3}{5}s.$ to $\frac{3}{5}l.$ First, $\frac{3}{5}s.=\frac{3}{5}$ of $\frac{1}{20}=\frac{3}{100}$.

Then $3\times100+5\times3=315$ $\frac{63}{100}$.

And $5\times100=500$.

Or more expeditiously by valuing both thus:

$\frac{3}{5}s.=7\frac{1}{5}d.$ and $\frac{3}{5}$ *L.*$=12s.$ together $12|7\frac{1}{5}$

3. Add *L.*4 : 15 : 6, and *L.*3, $\frac{7}{8}$. First, 15*s.* 6*d.*$=\frac{31}{40}$.

$$\begin{array}{r} \text{Therefore, } 7\times40=280 \\ 31\times\ 8=248 \\ \hline 528 \\ \hline 8\times40=320 \end{array} =1\tfrac{208}{320}$$

$$\begin{array}{r} 3 \\ 4 \\ \hline 8\frac{208}{320}. \end{array}$$

Or

$$\left.\begin{array}{r}\text{Or to } L.4 : 15 : 6 \\ \text{Add } L.3\tfrac{7}{8} = 3 : 17 : 6\end{array}\right\} = L.8 : 13 \text{ Anſwer.}$$

4. Add $4\frac{1}{2}$ and $3\frac{1}{3}$. Anſwer, $\frac{47}{6}$ or $7\frac{5}{6}$

5. Add $L.\frac{3}{7} + \overset{s.}{\frac{3}{7}} + \overset{d.}{\frac{3}{7}}$. Anſwer, $\overset{s.}{9} : \overset{d.}{0\frac{3}{7}}$

6. Add $L\ \frac{3}{4}$ of $\frac{3}{5} + \frac{9}{10}$ of $\frac{6}{7} + \frac{5}{8}$. Anſwer $1\frac{237}{280}$.

7. Add $L.\frac{3}{4} + L.\frac{3}{8} + \frac{3}{4}s. + \frac{3}{4}d.$ Anſwer, 23 | $3\frac{3}{4}$.

8. Add $\frac{1}{2}$ of $\frac{1}{3} + 13\frac{3}{4} + 24\frac{5}{6}$. Anſwer, $38\frac{3}{4}$.

Obſ. If reduction is well underſtood and remembered, the addition of fractions will be very eaſy; the reaſon of which will be obvious if we conſider that the given fractions being ſuch, or reduced to ſuch a ſtate, that all the numerators repreſent things of the ſame denomination, both abſolute and relative; their ſum muſt therefore be a number of ſuch parts as the common denominator expreſſes of the ſame common integer.

CHAP. III.

SUBTRACTION OF VULGAR FRACTIONS.

RULE

REDUCE the given fractions to ſimple ones of the ſame integer and denominator, as in addition, and the difference betwixt the numerators, with the common denominator will be the fractional difference required.

EXAMPLES.

(1.)

$\frac{4}{5} - \frac{3}{5} = \frac{1}{5}$.

(2.)

$$\frac{5}{6} - \frac{3}{4} \quad \begin{array}{l} 5\times4=20 \\ 6\times3=\underline{18} \\ \qquad\ \ 2 = \frac{1}{12} \\ 6\times4=24 \end{array}$$

(3.)

$\frac{3}{4}l. - \frac{3}{4}s. = \frac{57}{80}$.

For $\frac{60}{80} - \frac{3}{80} = \frac{57}{80}$.

II. Of DECIMAL FRACTIONS.

INTRODUCTION.

IN decimal fractions, an unit is supposed to be divided into 10 equal parts, each of these into 10 other equal parts, and each of these into 10 other equal parts, if necessary, and so on *ad infinitum*.

A decimal fraction is distinguished from an integer by a comma or point prefixed to it, whose denominator, though seldom or never expressed, is easily known by the distance of the first figure to the right hand, from the separating point, counted as 1, at the same distance in the numeration table, from the units place. Hence .5 is expressed $\frac{5}{10}$, .75 as $\frac{75}{100}$, .05 as $\frac{5}{100}$, .005 as $\frac{5}{1000}$, &c. As the flux of increase is to the left of the units place, and of decrease towards the right, it follows, that a figure standing in the second place after the point will only be $\frac{1}{10}$ of the value of the same figure in the first place after the point; in the same sense that a figure in the units place is only $\frac{1}{10}$ of the same figure in the place of tens. For this reason ciphers standing between significant figures and the point, decrease the value of these figures, in the same proportion, the same number of figures on the left of the point would raise the value of the figures preceding them. Hence, also, ciphers on the right of significant decimal places, have the same effect as ciphers on the left of integers which in both amounts to nothing; so that .50,=.5, for $\frac{50}{100}=\frac{5}{10}$: but, .05=.5÷10.

Since the decrease in decimals is carried down in one uninterrupted chain from the unit's place, it follows, that decimal places are added, subtracted, multiplied, and divided as integers, excepting where in any instance the decimal expression falls short of the vulgar.

When the decimal expression precisely equals the vulgar, the decimal is in that case said to be finite, but when there is a repetition of the same figure, or figures, it is then said to be infinite or interminate, and differently denominated from the manner of the repetition. From this brief account of the nature of decimals, their excellency in expediting calculation will be obvious.

CHAP. I.

REDUCTION OF DECIMALS.

Prob. 1. To reduce a vulgar fraction to a decimal.

Divide the numerator by the denominator; and as ciphers must be annexed to the numerator before the division, the quotient must consist of as many places as the numerator had ciphers annexed to it, which will be the decimal required.

EXAMPLES

EXAMPLES.

(1.) Red. $\frac{4}{5}$ to a decimal. 5).8$\frac{40}{8}$.

(2.) Red. $\frac{3}{8}$ to a decimal. 8).375$\frac{3000}{375}$.

(3.) Reduce $\frac{1}{20}$ to a decimal. 20).$\frac{100}{05}$.

(4.) Reduce $\frac{1}{80}$ to a decimal. 80).$\frac{100}{0125}$.

Note, It will often happen, that, in the diviſion, there will continually be a remainder, and the quotient repeat the ſame figure or figures *ad infinitum*; in which caſe, it will be unneceſſary to carry on the diviſion farther, when you have once got the repetend, which may be ſingle, repeating always the ſame figure; or compound, always repeating or circulating the ſame figures. A ſingle repetend may be marked or diſtinguiſhed with a point above it, and compounds with a point above the firſt and laſt figures of the circulation.

ADDITION OF DECIMALS.

CHAP. II.

Caſe 1. HAVING placed the numbers to be added, whether pure decimals or mixed numbers, ſucceſſively below one another, in ſuch a manner as the ſeveral points may be in one column, tenths under tenths, hundreds under hundreds, &c.; if the given decimals are finite, add them as integers, and mark the ſeparating point in the ſum directly under the points of the given decimals, or point off as many for decimals as were in any of the given numbers which had moſt places.

EXAMPLES.

75.436	$59\frac{1}{4} = 59.25$
47.324	$67\frac{1}{2} = 67.5$
3.21	$48\frac{3}{4} = 48.75$
6.7547	$8\frac{1}{8} = 8.125$
.307	$9\frac{1}{20} = 9.05$
.005	
133.0367	$192\frac{27}{40} = 192.675$

Reduce and add as follows:

L.196	17	6 =	
194	18	9 =	
67	14	3 =	
45	0	9 =	
76	16	6 =	
9	10	6 =	
4	12	$8\frac{1}{4}$ =	
		=	595.546875

Reduce and add as follows:

L.497	19	9 =	
385	18	3 =	
176	14	$1\frac{1}{2}$ =	
84	0	3 =	
97	19	0 =	
47	0	$0\frac{3}{4}$ =	
		=	1288.621875

Case 2. When all, or any of the decimals, repeat a single digit, make the repetends conterminous, and add 1 to the sum of the first, or right hand column, for every nine that is contained in it.

EXAMPLES.

$475\frac{2}{3}$ = 475.6666		L.59	7	$7\frac{3}{4}$ =	L.59.3822916
$397\frac{1}{6}$ = 397.1666		57	17	5 =	57.8708334
$475\frac{5}{6}$ = 475.8333		57	13	4 =	57.6666666
$99\frac{1}{9}$ = 99.1111		25	6	8 =	24.3333333
$8\frac{5}{9}$ = 8.5555		45	13	4 =	45.6666666
$1456\frac{1}{3}$ = 1456.3		245	18	$4\frac{3}{4}$ =	245.9197916

Reduction

Reduce and add as follows:

L.76	13	4	=
97	6	8	=
14	3	4	=
19	14	$3\frac{1}{2}$	=
14	0	7	
18	0	$0\frac{1}{4}$	
17	19	$11\frac{3}{4}$	
15	15	$6\frac{1}{4}$	
			=273.6864583

89	17	5
159	7	$7\frac{3}{4}$
346	13	4
414	18	8
97	0	$5\frac{1}{4}$
89	19	11
67	4	7
59	9	4
		=1324.56

OBSERVATION.

The finite value of a pure circulate is a fraction whose numerator is the repetend, and denominator a number of as many places of nines, with a number of ciphers on the right, equal to the places betwixt the point and repetend. Hence where the conterminous repetends of several circulates are added, their sum is a numerator to the common denominator; and if one for every nine in the sum is added thereto, it is reduced to the finite expression.

CHAP. III.

SUBTRACTION of DECIMALS.

Case 1. PLACE the numbers homogeneous under homogeneous, so as point may be under point; then, when the decimals are finite, subtract as in integers, and let the point in the remainder stand directly under those of the factors.

EXAMPLES.

From	L.74	19	6=74.975		L.171	13	6=171.675
Take	18	11	9=18.5875		97	18	9= 97.9375
	56	7	9 56.3875		73	14	9= 73.7375

Reduce and subtract as follows:

								lb.	*oz.*	*dwt.*	*gr.*
L.1741	13	6		917	16	6		187	4	10	0
987	15	9		578	17	6		99	10	12	$19\frac{1}{2}$
753.875				338.95				87.48			

Case

Case 2. If a single digit is repeated, borrow 9 in the first repeating place when necessary.

EXAMPLES.

From	L.7849	6	8=7849.333		L.17	11	7=17.57916	
Take	6979	13	4=6979.666		14	16	8=14.83333	
	869	13	4= 869.666		2	14	11= 2.74583	

From	L.54	1.	6	714	13	4	119	11	2
Take	25	11	11	335	16	8	17	18	6
	28 . 4716			378 . 83			101 . 6416		

CHAP. IV.

MULTIPLICATION OF DECIMALS.

Case 1. WHEN the decimals are finite, find the product as in integers, from which point off as many for places as were in both factors; if the whole product doth not count so far, supply that defect by prefixing ciphers.

EXAMPLES.

368.5	672.5	.246
2.75	.365	.125
18425	33625	1230
25795	40350	492
7370	20175	246
10.13375	245.4625	.036750

OBSERVATION.

If we conceive the two given numbers as fractions, it will be plain that the numerators and denominators are multiplied together respectively, since as many places are taken from the product, as there are in the denominators of both factors; which likewise accounts for prefixing ciphers, when there are otherwise not so many places in the product as were in both factors.

3. At

3. At L. 3 : 7 : 6 what coſt $4\frac{1}{2}$ pieces of linen?

Anſwer, 3.375×4.5=15.1875.

4. At L.4: 11 : 9 what coſt $8\frac{3}{4}$ pieces of linen?

Anſwer, L.40.165625.

5. What coſt $375\frac{1}{2}$ yards tape at $1\frac{1}{2}$ d. *per* yard?

Anſwer, L.2.346875.

6. What is the ſquare content of a room 18 *f.* 9 *inch.* by 16 *f.* 4 *inch.*?

Anſwer, 306.75 *feet.*

7. There is a court 124 *feet.* 9 *in.* by 110 *feet.* 6 *in.* to be paved with ſtones 12 inches ſquare; how many will it require?

Anſwer, 13784.875.

CONTRACTIONS.

All the contractions in the firſt part, which regard multiplication, may be applied here, but the following ſeem peculiarly adapted to multiplication of decimals.

1. To multiply by 10, 100, 1000, &c. remove the decimal point ſo many points further to the right, as there are ciphers in the multiplier.

As, 47.565×100=4756.5, and .45×1000=450, &c.

2. When the places of decimals run far in both factors, the work may be contracted to as few places of decimals as may be thought ſufficient for the purpoſe, by the following rule.

Set the units place in the multiplier directly under that figure of the decimal part in the multiplicand, whoſe place you would preſerve in the product; invert all the other figures of the multiplier, and, in multiplying, begin with the figure of the multiplicand, which ſtands over the figure wherewith you are then multiplying; and ſet down the firſt figure of every particular product directly under each other, remembering at the ſame time to add the increaſe which would ariſe from the multiplication of the two next right-hand figures of the multiplicand, to the firſt figure of every product; that is, if the product of the next right-hand figure, with as many units added to it as there are tens in the product of the ſecond right-hand figure, be any number betwixt 5 and 15, carry 1 : if 15, or any number below 25, carry 2, and ſo in proportion.

EXAM-

EXAMPLES.

Multiply 54.321711 into 3.12321, and preserve 4 decimal places in the product.

	54321711
	12321.3
543217×3 =	1629651
54321×1+1 =	54322
5432×2 =	10864
543×3+1 =	1630
54×2+1 =	109
5×1 =	5
	1696381

Multiply 231.3121 into 21.32 and save 3 decimal places.

231.3121
23.12
4626242
231312
69394
4626
4931.574

All these cases of circulating decimals might be effected as intelligibly, though not so quickly, by managing them as vulgar fractions.

CHAP. V.

DIVISION OF DECIMALS.

Case 1. WHEN the decimals are finite, the quotient is found, as in integers, and in all cases pointed or valued, by the following rules.

1. If the places in the divisor and dividend are equal, the quotient is integral.

2. If the divisor hath most places, annex ciphers to the dividend, to make them equal, and the quotient will still be integral.

3. If the dividend hath most places, point off places for the excess in the quotient.

4. If the whole quotient is not equal to the excess, prefix ciphers for the defect.

Note, If, after the quotient is qualified, there be a remainder, the division may be continued at pleasure.

EXAMPLES

EXAMPLES.

(1.)

24.35)78345.15(3217
7305.

5295
4870

4251
2435

18165
17045

1120

(2.)

.4725)113.4
4725)113.4000(240
9450

18900
18900

....0

(3.)

2.87)67.05627(23.364
574

965
861

1046
861

1852
1722

1307
1148

159

(4.)

.543).0020091(.0037
1629

3801
3801

0

ILLUSTRATION.

In the first example, the places in each factor are two, and the quotient is integral.

In the second example, because the divisor consisted of four places, and the dividend but of one, three ciphers were annexed to the dividend, which made the places in both equal, and the quotient was accordingly integral.

In the third example, because there were five places in the dividend, and but two in the divisor, the excess, 3, was pointed off for decimals.

In the fourth example, as there were seven places in the dividend, and three in the divisor, the quotient required four places of decimals; and as there were but two places in the quotient, two ciphers were prefixed to make up the deficiency.

OBSERVATION.

The rationale of valuing or qualifying the quotient will appear, if we consider, that the product of the quotient and divisor is equal to the dividend, and consequently the places of the divisor and quotient, counted together, will always be equal to the dividend; or, which is the same thing, the number of places in the quotient must be equal to the difference of the places in the divisor and dividend.

CONTRACTIONS.

1. In dividing by 10, 100, 1000, &c. the quotient is found by removing the decimal point in the dividend so many steps towards the left hand, as there were ciphers in the divisor. Hence,

$$\frac{34\cdot5}{10} = 3\cdot45, \text{ and } \frac{34\cdot5}{100} = \cdot345$$

2. The work of division may be contracted in the same manner as multiplication, by the following

RULE.

Having considered in what place the first figure of the quotient ought to stand, and so found its value, or demonination, take as many of the left hand figures as you intend to have figures in the quotient, for the first divisor, and then take as many figures of the dividend as will answer them; in dividing, omit, or point off one figure at each operation, at the same time judging as exactly as possible what would be the increase arising from the figure or figures so omitted.

EXAMPLES.

EXAMPLES.

384.672158)14169.2066238510(36.8345
11540.16474

26290.4188.
23080.3295.

3210.0893 ..
3077.3772 ..

132.7121 ...
115.4016 ...

17.3105 ....
15.3869 ....

1.9236 ......
1.9234 ......

9.365407)87.076326(9.297655
84.288663

2.787663
1.873081

914582
842886

71696
65558

6138
5619

519
468

51
47

4

All the other contractions proposed in the division of integers may be very properly applied here.

Applicate Questions in Decimal Fractions.

1. What is the decimal difference betwixt *L.* 1 and 13*s.* 4 *d.*?

s.	d.		
			1.000
13	4	=	0.666
			.333 Answer.

2. What is the square content of a room, 15 feet 6 inches by 14 feet 9 inches?

$\frac{1}{2}$)14.75
15$\frac{1}{2}$

221.25
7.375

228.625 = 228 *f.* 7$\frac{1}{2}$ *in.*

3. What

4. What is the tunnage of a bale 9 feet 9 inches long, 7 feet 3 inches broad, and 5 feet 6 inches thick?

$$
\begin{array}{r}
9.75 \\
7\frac{1}{4} \\
\hline
68.25 \\
2.4375 \\
\hline
70.6875 \\
5.5 \\
\hline
353.4375 \\
3534.375 \\
\hline
4.0)388.78125 \text{ solid content.} \\
\hline
9.71953125 \text{ tunnage.}
\end{array}
$$

5. A piece of cloth, consisting of $25\frac{1}{2}$ yards, is valued at *L.* 23: 17: $5\frac{1}{2}$; how must one yard be valued at the rate?

$$
\begin{array}{r|l}
25.5 & 23.871916 \\
\hline
5.1 & 4.774583 \\
\hline
 & .9361927 = 18s.\ 8\frac{1}{4}d.
\end{array}
$$

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PART III.

The APPLICATION of ARITHMETIC to the Business of the MERCHANT, the BANKER, CUSTOM-HOUSE, INSURANCE OFFICE, &c.

CHAP. I.

SIMPLE PROPORTION, or RULE of THREE.

PROPORTION may be defined in general, The indentity, similitude, or equality of ratios, as ratio is the relation, or habitude of two numbers, which determines the value of the one from the value of the other; for instance, the ratio of 4 and 8 is 2, and the ratio of 8 and 16 is likewise 2; hence, the relation betwixt 4 and 8, and 8 and 16 being the same, these four numbers are said to be in proportion.

The rule of proportion, or rule of three, finds a fourth proportional to three numbers given, one of which shall have the same ratio to that fourth, which exists betwixt the remaining two, as will be demonstrated in the algebraic part. But to speak in applicate terms:

Proportion is that rule, by which the value, quantity, or number of one species of things is proportioned to the value, quantity, or number of another species of things, according to some fixed stipulation, or known conclusion. For instance, if I purchase 4 yards of cloth for 10 shillings, and then agree to take the piece of 16 yards at the same price *per* yard; it is plain that the thing required here, is to proportion the price of 16 yards to the price stipulated for 4 yards, by still preserving the same ratio betwixt 16 yards and the price thereof, as betwixt 4 yards and the stipulated price of 10 shillings.

Thus,

Thus, 4 yds. : 10 s. : : 16 yds. : 40 s.; in which 16 hath the ſame ratio to 40 that 4 hath to 10, and 10 the ſame ratio to 40 that 4 hath to 16.

All queſtions in this rule are either in a direct or reciprocal proportion.

1. Direct, when the firſt bears the ſame ratio to the ſecond as the third doth to the fourth; in which caſe, the greater the ſecond term is in reſpect to the firſt, the greater will the fourth term be in reſpect to the third, and the contrary. 4 : 10 : : 16 : 40. Here, becauſe 10 is greater than 4, 40 is proportionally greater than 16; and 40 : 16 : : 10 : 4. Here, becauſe 16 is leſs than 40, 4 is of conſequence leſs than 10 in the ſame proportion. Hence we have this corollary for proving all operations in direct proportion, that the product of the extremes will always be equal to that of the means; for it is plain, that $4 \times 40 = 10 \times 16$, and that $40 \times 4 = 16 \times 10$.

2. Reciprocal, when the third bears the ſame ratio to the firſt, as the ſecond doth to the fourth; in which caſe the leſs the third term is in reſpect to the firſt, the greater will the fourth term be in reſpect to the ſecond, and *vice verſa*. For inſtance: Suppoſe 8 men could do a certain piece of work in 4 days, and it were required to know in what time 16 men could do it; upon the leaſt conſideration it would occur, that 16 hands would do more work than 8, and conſequently require leſs time, wherefore. as 8 : 4 : : 16 : 2. In which 16 bears the ſame proportion to 8, that 4 doth to 2; and by ſhifting the ſuppoſition, 16 : 2 : : 8 : 4. Hence, when the terms are in reciprocal proportion, the product of the two firſt terms will always be equal to the product of the two laſt; for $8 \times 4 = 16 \times 2$, and $16 \times 2 = 8 \times 4$.

From the foregoing conſiderations are deduced the following rules.

1. For ſtating, or ranking the numbers in a proportional order. Make that number the third term upon which the demand lies; that number the firſt term which is of the ſame kind, or ſignifies the ſame thing, with that term which was made the third; then will the remaining one, which is to poſſeſs the ſecond place, be of the ſame kind, or ſignify the ſame thing, with the fourth, or number required.

2. For finding a fourth proportional. If the terms are in direct proportion, that is, if more require more, or leſs require leſs, the product of the two laſt divided by the firſt will quote the anſwer, or 4th proportional.—But if the terms are in reciprocal proportion, that is, if more require leſs, or leſs require more, the product of the two firſt divided by the laſt will quote the anſwer.

EXAMPLES.

EXAMPLES.

1. Bought 1420 yards of ofnaburgs, at 12*s.* the fcore, or 28 yards; what will be the charge of the whole?

yds. *s.* *yds.* *L.* *L.* *s.*
First 20 : 6 = 12 : : 1420 : 42.6 = 42 12
For 1420
6

2|0)85.20

42.6
And 20×42.6 = ×1420.

2. It iscomputed that 6 men would build a wall in 40 days; but the proprietor would have it finifhed in 10 days; how many men, according to that computation, muft be hired for building the wall?

days. *m.* *days.* *m.*
First 40 : 6 : : 10 : 24
For $\frac{40\times6}{10}$ = 24 men
and 40×6 = 10×24.

Illuftration of the laft two examples.

In the firft example, the number upon which the demand lies is 1420 yards, and therefore, by the rule, it ftands in the third place; the correfpondent number to 1420 yards muft be that one of the other two which implies yards, or fome denomination of that integer, which in this cafe is found to be 20 yards, and therefore, by the rule, adopted for the firft term: but to prove that we are fo far right, we have ftill another check, namely, that the remaining term for the fecond place muft be money, becaufe by the queftion the anfwer muft be money: here we find it is 12 fhillings, and therefore we may conclude that the terms are properly ftated.

Next

Next, we consider that the 3d term, 1420 yards, contains a greater quantity than the first term, 20 yards, and consequently requires a greater price; therefore we conclude the terms to be in direct proportion, and find the answer, by dividing the product of the two last terms by the first.

In the second example the demand lies upon ten days for the 3d term, to which 40 days correspond for the first; and 6 men must be the second, because it corresponds with what is required. It will likewise be obvious, that to finish any work in ten days, will require more men than it would do to finish it in 40 days, and therefore we conclude that the terms are in reciprocal proportion.

OBSERVATION.

When the terms are mixed numbers, or of different denominations, they may be made homogeneal by reduction, vulgar fractions, or decimals; and the operations thereafter abbreviated, when possible, in any of those methods proposed in the first part, which may seem most adapted to the purpose; or by other methods which judgment and experience may dictate, equally, and perhaps still better calculated for dispatch.

To give a more particular idea of my meaning, I shall vary the work of the next question, by different methods of operation, and afterwards give the solution of others in that method which bids fairest for dispatch which, next to accuracy, ought to be the principal object attended to by an accountant; and though some figures that are not necessary to the operation, such as the stating of the questions, for the sake of illustration, may be introduced, no figure shall be omitted, for the sake of an affected brevity, which I myself have occasion to use in the operation.

Quest. 3. If for $5\frac{3}{4}$ yards of velvet I get *L.* 4:12, what may I reckon $84\frac{1}{2}$ yards worth, which is all that I have of the kind?

1. By reduction.

Yds.	*L.*	*s.*		*Yds.*		*L.*	*s.*
$5\frac{3}{4}$	: 4	12	::	$84\frac{1}{2}$	:	67	12
4	20			4			
23 *qrs.*	92*s*			338 *qrs.*			

$$
\begin{array}{r}
338 \\
92 \\
\hline
676 \\
3042 \\
\hline
23)31096 \\
\hline
2|0)135|2s. \\
\hline
L.67\ 12.
\end{array}
$$

2. By vulgar fractions.

$$\begin{array}{ccccccccc} \textit{Yds.} & & \textit{L.} & & \textit{L.} & & \textit{Yds.} & & \textit{L.} \\ \frac{23}{4} & : & \frac{92}{20} & \text{or} & \frac{23}{5} & :: & \frac{169}{2} & : & \frac{15548}{230} \end{array}$$

$$\text{For } \frac{\frac{23}{5} \times \frac{169}{2}}{\frac{23}{5}} = \frac{15548}{230} = L.67 - 12$$

3. By decimals.

Abridge the dividing and multiplying terms equally by 5, and they will stand thus

	Yds.	L.	Yds.
	5.75 :	4.6 ::	84.5
	1.15 :	4.6 ::	16.9
Again	.23 :	4.6 ::	3.38
by 23	.01 :	.2	.2
		.01)	.676
			67.6

4. By component parts.

Yds.		L.	s.		Yds.		L.	s.
$5\frac{3}{4}$	:	4	12	::	$84\frac{1}{2}$	:	67	12
			7					
		32	4					
			12					
		386	8	into 84				
		2	6	into $\frac{1}{2}$				
	23)	388	14					
		16	18					
			4					
		L.67	12	Answer.				

Many of these figures might have been omitted but for illustration.

5. By multiplying the number of yards $84\frac{1}{2}$ into the price of 1 yard, $\frac{1}{4}$ of which is found by dividing the given price 92*s*. by the number of quarters in the first term 23, and the quotient will be 4*s*. which multiplied by 4, produces 16*s*. then $16 \times 84\frac{1}{2} = 1352$, as formerly.

6. Or take $\frac{1}{4}$ for 4*s*. of 338 quarters, and you will have *L*. 67, 12*s*. as before.

7. Or multiply 84 5 by .8, the decimal of 16*s*, and it will produce *L*. 67, 12*s*.

Quest. 8. What will 245 days salary amount to at 85 guineas *per annum*?

Because the third term is days, the first term will be 365 days = 1 year, and that term and the third being each divided by 5, the terms will stand abridged thus:

Days	L.		Days.	L.	s.	d.
73	: 89.25	: :	49 :	57	18	$1\frac{1}{6}$

For 89.25
7
———
624.75
7
———
73)4373.25
———
59.907 = *L*. 59 18 $1\frac{1}{6}$.

Quest. 9. When the bushel of wheat sold at 10*s*. the fourpence loaf weighed $4\frac{1}{2}$ *lb*. what should the sixpence loaf weigh, when the bushel of wheat sells at 15*s*.

	s.		*lb*.		*s*.	
First,	10	:	4.5	: :	15	reciprocally : 3.
	d.		*lb*.		*d*.	*lb*.
And,	4	:	3	: :	6	: $4\frac{1}{2}$

These numbers are so simple, that the operation may be entirely mental.

Quest.

Quest. 10. What may one save at the year's end, who hath *L.* 456, 15*s. per annum*, and spends only *L.* 4 : 13 : 4 *per* week?
First find what he spends a-year.

Week.	*L.*	*s.*	*d.*		*Weeks.*	*L.*	*s.*	*d.*
1 :	4	13	4	: :	52 :	242	13	4

For 4 13 4 or 3 | 52
            10        $4\frac{2}{3}$

5)46 13 4
         5
233 6 8
   9 6 8
He spends annually 242 13 4

208
 17 6 8
 17 6 8
242 13 4

	L.	*s.*	*d.*
He hath	*L.* 456	15	0
He spends	242	13	4
He saves	214	1	8

Quest. 11. A merchant, in balancing his book, finds he is due *L.* 575, 17*s.* and that his whole subject taken together goes no higher than *L.* 487, 18*s.* 6*d.*; how much may he offer his creditors of the pound?

Debt.		*Subject.*		*D.*		*Sub.*
575.85	:	487.925	: :	1	:	16 $11\frac{3}{8}$

For 575.85)487.925(847 = 16 *s.* $11\frac{3}{8}$ *d.* Ans.
460680
272450
230340
421100
402095
18005

Quest. 12. A merchant wants a piece of ground before his land or tenement paved with stones, 3 feet by 2; the ground is 30 yards by 4; required the number of stones?

30 *Yards*
4
Feet ———
120
3 9
— *St.* ———
6 : 1 :: 1080 : *Stones.*
For 6)1080
———
180 Anſwer.

Queſt. 13. If I lend a friend *L.* 200 for 6 months, how long ought I to retain *L.* 500 of his at another time, to indemnify myſelf?

L. *m.* *L.* *m.*
200 : 6 :: 500 : $2\frac{2}{5}$. Anſwer.

Queſt. 14. When *L.* 36 valued rent pays 4*s.* 10*d.* of ceſs, what will *L.* 70 pay?

L. *s.* *d.* *L.* *s.* *d.*
36 : 4 : 10 :: 70 : 9 : $4\frac{7}{9}$
7
———
33 10
5
———
6)169 2
——— ———
3)28 $2\frac{1}{3}$
——— ———
s. 9 $4\frac{7}{9}$ *d.* Anſwer.

The following questions are proposed and answered: but the young practitioner is referred, for the method of solution, to the application of the foregoing.

Quest. 15. Suppose a purchase is made of 5 pieces Dutch holland, each measuring 56 Flemish ells, at 3*s.* 2*d. per* ell Flemish, what will be gained upon the whole, if it is sold at 5*s.* 8*d. per* ell English? Answer, *L.*3 : 5 : 4.

Quest. 16. When wheat was at 12*s.* the bushel, the 6*d.* loaf weighed 1 *lb.* 4 *oz.*; what ought it to weigh when the wheat falls to 9*s.* 6*d.*? Answer, 1 *lb.* 8 *oz.* 4 *dwts.* 3 *gr.*

Quest. 17. There is an island 134 miles in circumference, in which at the same instant, and from the same point, *A* and *B* set out back to back, to travel round it. *A* travels 11 miles every 2 days, and *B* 17 every three days. After what time, and how many miles travel to each, will they meet? Answer, *A* will travel 66 miles, *B* 68, and they will meet in 12 days.

Quest. 18. If the longest end of the beam of a balance be 36 inches, and the shortest 27; how much suspended on the shortest end will equiponderate 84 *lb.* on the longest end?
Answer, 112 *lb.*

19. Suppose an acre of land 4 falls broad and 40 falls long, should be excambed with another acre 9 falls in breath; required the length sufficient to complete the acre? Answer, $17\frac{7}{9}$.

20. Bought $\frac{2}{7}$ of a ship for *L.* 217 : 10 : 10; what will $\frac{2}{9}$ cost at that rate? Answer, *L.* 169 : 4 nearly.

21. A man had a 99 years lease, and being asked how much of it was run, answered that $\frac{2}{3}$ of the time past was equal to $\frac{4}{5}$ of the time to come; required the particulars?

Answer, 54 years past, and 45 to come.

CHAP II.

COMPOUND PROPORTION.

IN this rule five numbers are given to find a sixth proportional, which may be answered by two successive operations in the last rule, but much more expeditiously as follows:

Of the given numbers three are conditional, or supposed, and the other two move the question; therefore, of the three conditional terms, let that which is the principal cause of gain or loss, increase, or decrease, action or passion, be put for the first term; that number which denotes distance of time or

place

place be put for the ſecond term, and the remaining number which will denote action, paſſion, gain or loſs, be put for the third term, then place the other two terms which move the queſtion in the ſame order with the preceding.

Rule 1. If the term ſought be of the ſame name with the firſt or ſecond, multiply the firſt, ſecond, and laſt terms continually for a dividend, and the other two for a diviſor, the quotient ariſing therefrom will be the ſixth proportional.

Rule 2. But if the term ſought be of the ſame name with the third, the continued product of the three laſt terms divided by the product of the firſt two, will quote the ſixth proportional.

Queſt. 1. If 8 men receive *L.*4, 16*s.* for 6 days work, how many men may be paid with *L.* 19, 4*s.* for 16 days work?

men	*days.*		*L.*		*days*		*L.*
8	: 6	: :	48	:	19	:	19.2

ILLUSTRATION.

If 8 men for 6 days work receive *L.* 4, 16*s*, Theſe are the conditional or ſuppoſed terms in the queſtion, and therefore poſſeſs the three firſt places; 8 men, as being the cauſe of action or gain, make the firſt term; 6 days, as being the ſpace of time, make the ſecond, and the money which is gained in that time becomes the third term: then becauſe days are put before money in the conditional terms, 16 days ſtand before *L.* 19.2 in the terms which move the queſtion. When the terms are compared, it occurs at once that a number of men is demanded, and therefore the queſtion is wrought by the firſt rule, and may be previouſly abridged as follows:

	men.	*days.*		*L.*	*days.*	
State reſumed,	8 :	6	: :	4.8 :	16 :	19.2
	1	1		.8	2)	24
				.1		12 Anſwer.

Here it is neceſſary only to divide 24 by 2 after the terms are abridged, whereas otherwiſe the proceſs would have been,

$$\frac{8\times6\times19.2}{6\times4.8}=12$$

Queſt.

Queſt. 2. If the intereſt of *L*. 100 for one year is *L*. 5; what will be the intereſt of *L*. 5780 in 120 days?

L.	*days.*	*int.*	*L.*	*days.*
100 :	365 :	5*l*. : :	5789 :	120
	73	1	120	

73)6936.00

L. 95 0 $3\frac{1}{4}$.

Here the term ſought was of the ſame kind with the third, and the anſwer found by the ſecond rule.

OBSERVATION.

If we put N=the given number of men in the firſt queſtion, t=6 days, their time, S= L. 4, 16*s*. their wages, T=16 days, the time propoſed in the queſtion, P=L. 19, 4*s*. the ſum propoſed; and a=the number of men required.

If we ſtate it twice, it will be

1. $S : N : : P : \frac{PN}{S}$ the number of men in equal times.

2. $t : \frac{PN}{S} : : T : a$

By multiplying extremes and means, it will be

$ta\frac{PNT}{S}$, and Sta=P N T;

and, by diviſion,

$a=\frac{PNT}{St}$, according to the rule, and ſo of any other.

Queſt. 3. An undertaker contracted to finiſh 500 yards of turnpike in 30 days, and for that purpoſe hired 60 men; but, at the expiration of 20 days, he found he had only got the length of 260 yards; how many men muſt be added to finiſh the work in the ſtipulated time?

m.	*d.*	*yds*	*d.*	*yds.*	
60 :	20 : :	260 :	10 :	240	500
					260

By

By abridging the terms, and cancelling an equal number of ciphers,

it will be $\overset{m.}{6} : \overset{d.}{1} :: \overset{y.}{13} : \overset{d.}{1} : \overset{yds.}{240}$

Then $\dfrac{6 \times 1 \times 240}{13} = \overset{men.}{110}$, from which deduce the men he had, *viz.*

$$\begin{array}{r} 110 \\ 60 \\ \hline 50 \end{array}$$ to be added

4. If 18 men build a wall 40 feet long, 3 feet thick, and 16 feet high in 12 days; how many men must be employed to build a wall 360 feet long, 8 feet thick, and 10 feet high in 60 days? Anſwer, 54.

OBSERVATION.

All queſtions in compound proportion whether conſiſting of 5, 7, 9, or 11 numbers are reducible to three, of which properly ſpeaking, they only conſiſt; for which reaſon the moſt complicated may be performed by ſimple proportion, as was demonſtrated at the beginning of this chapter, in numbers thus, by reſuming queſtion 4.

	A.	*C.*	*A.*	*C.*	*A.*	*C.*	*A.*	*C.*	
	60 :	12 : :	16 :	10 : :	3 :	8 : :	40 :	360 : :	18
	Conſ.prod. of Ant.				*Con. product of conſ.*				
Therefore	115200	:			345600	: :	18	:	54.

CHAP. III.

RULE OF CONJUNCTION.

THE rule of conjunction joins together ſeveral ſtatings in the rule of proportion into one, and by the relation that ſeveral antecedents have to their conſequents, the proportion between the firſt antecedent and the laſt conſequent is diſcovered, as well as the proportion between the others in their ſeveral reſpects.

To diſpoſe this rule aright, the antecedents muſt be ranged in the left-hand column, and the conſequents in the right-hand one.

The firſt antecedent and the laſt conſequent, whoſe antecedent is ſought, muſt be of the like ſpecies; ſo muſt the ſecond conſequent and the third antecedent; and this order muſt be continued throughout the whole.

The terms being thus diſpoſed, the diviſor is found by multiplying all the antecedents into one another continually, and the dividend by multiplying all the conſequents in the ſame manner, the quotient ariſing from theſe two factors gives the antecedent required.

The

This rule may be so abridged by cancelling equal quantities and abbreviating commensurables, that the whole operation may be performed with very little trouble.

EXAMPLES.

1. Suppose 100 *lb.* of Amsterdam=100 *lb.* of Paris, 100 *lb.* of Paris=150 *lb.* of Genoa, 100 *lb.* of Genoa=70 *lb.* of Leipsic, 100 *lb.* of Leipsic=160 of Milan, how many *lbs.* of Milan will equiponderate 548 *lb.* of Amsterdam?

Antecedents.		Consequents.	Abridged.	
lb.		*lb.*	Ant.	Con.
100 of Amsterdam	=	100 of Paris.	5	3
100 of Paris	=	150 of Genoa,	5	2
100 of Genoa	=	70 of Leipsic,		7
100 of Leipsic	=	160 of Milan,		548
how many of Milan	=	548 of Amsterdam?		

Then $\dfrac{3\times2\times7\times548}{5\times5\cdot5}=920\frac{16}{25}$ *lb.* of Milan= 548 *lb.* of Amster.

ILLUSTRATION.

The two 100's on both sides cancel each other, and let the last cipher of the three remaining antecedents be cancelled, 100 *lb.* of Paris, 100 *lb.* of Genoa, and 100 *lb.* of Leipsic, which is dividing them by 10; and, to preserve the equality on the side of the consequents, cancel also the last ciphers in 150, 70, and 160; after which divide one of the remaining 10's on the antecedent side by 5, and the 15 on the consequent side by 5, and the quotients will be 2 on the side of the antecedents, and 3 on that of the consequents: then 2 will measure 2 on the antecedent side, and 16 on the consequent side; as it will do 10 and 8, and the quotients thereafter will be 5 and 4; which being again repeated for the remaining 10 and 4 on both sides, leaves another 5 on the antecedent side, and 2 on the consequent side. And as there is no further room for abridging, by reason of the odd numbers 5 and 5 on the one side, and 7 and 3 on the other, the operation is made, and the answer found as above.

The use of this rule may be extended to all questions in proportion whatever, whether simple or compound, integral or fractional.

Exam. 2. If 12 yards of cloth cost *L.* 10, 10*s.* what will 20 yards cost?

Ant.	Con.	Abridged.	
12 *yds.*	*L.* 10.5	3	10.5
What will 20 *yds.* cost?			5

Then $\dfrac{10.5\times5}{3}$ = *L.* 17 10.

CHAP. IV.

RULES OF PRACTICE.

THESE compendiums in proportion, which are distinguished by the name of the *rules of practice*, because they were invented occasionally by merchants in expediting practice, comprehend a great part of the calculations used in counting-houses, particularly when an unit is the first term in the proportion; and it is certain, when any process is short and unperplexed, one is less liable to error than when he hath to do with heavy multiplications and divisions. In order to assist the young practitioner, I have inserted a table of aliquot parts, and given the method of inventing it.

Table of the aliquot parts of a pound

s.	d.		s.	d.	
10	0	$=\frac{1}{2}$	1	8	$=\frac{1}{12}$
6	8	$=\frac{1}{3}$	1	0	$=\frac{1}{20}$
5	0	$=\frac{1}{4}$	0	8	$=\frac{1}{30}$
4	0	$=\frac{1}{5}$	0	6	$=\frac{1}{40}$
3	4	$=\frac{1}{6}$	0	4	$=\frac{1}{60}$
2	6	$=\frac{1}{8}$	0	3	$=\frac{1}{80}$
2	0	$=\frac{1}{10}$	0	2	$=\frac{1}{120}$

This table, and any other of the same kind, may be effected by reducing the given parts or denominations to the lowest name mentioned in them for a divisor, and an unit of the integer to the same name for a dividend, the quotient is the fractional part in the lowest terms; for instance, 6*s.* 8*d*=80 pence, and *L.* 1=240 pence; but $\frac{240}{80}=3$, consequently, 6*s.* 8*d.*$=\frac{1}{3}$ of *L.* 1; and so of any other.

Case 1. When the price of the integer is any aliquot part of a pound contained in the table, the answer is found by one single division.

Exam. 1. At 10*s.* what cost 375 yards?

2) 375

L. 187 10 for $\frac{1}{2}$ of *L.* 1 remaining=10*s.*

Exam.

Exam. 2. At 6*s*. 8*d*. what cost 545*lb*?

3)545

L.181 13 4; here the remainder is 2×6*s*.8*d*.

Exam. 3. At 5*s*. what cost 475 yards?

4)475

L.118 15; for $\frac{3}{4}$=15*s*.

Exam. 4. At 4*s*. what cost 274 yards?

5)274

L. 54 16; for $\frac{4}{5}$=16*s*.

Exam. 5. At 2*s*. 6*d*. what cost 875*lb*.?

8)875

L.109 7 6; for 3×2*s*. 6*s*.=7*s*. 6*d*.

Case 2. When the given price is any even part of a pound less than 2*d*. it will be an even part of some of those mentioned in the table, and the answer is found by dividing and subdividing accordingly. The remainders may be valued as above, or carried on decimally.

Exam. 1. At one farthing what cost 3600 yards?

12)3600

80)300 threepences for 12 *qrs*.=3*d*.

L.3 15 by the table.

Exam. 2. At 1$\frac{1}{4}$*d*. what cost 504 yards?

1$\frac{1}{4}$*d*.=$\frac{1}{4}$ of 5*d*. therefore 4) 504

6)126 fivepences.

8) 21 half-crowns.

L.2 12 6 by the table.

 Case

Case 3. If the given price is no aliquot part of a pound, it will be composed of aliquot parts, which either may be divided for severally as before, or, when the remaining part is any even part of the foregoing, divide the quotient for it, and the sum of the quotients will give the answer. Sometimes we can, with great propriety, divide for the nearest aliquot part above the given price, and when the value of the difference is subtracted from that quotient, the remainder will be the answer. A few examples will be the best illustration.

Exam. 1. At $2\frac{1}{2}d.$ what cost 8754 *lbs*?

$$\begin{array}{lrrrl} & 120)8754 & & & \\ \frac{1}{2}d. \text{ is } \frac{1}{4} \text{ of } 2d. & 4)72 & 19 & 0 & \text{at } 2d. \\ & 18 & 4 & 9 & \text{at } \frac{1}{2} \\ \hline & L.91 & 3 & 9 & \end{array}$$

Or,

$$\begin{array}{rl} 2\frac{1}{2} = \frac{1}{8} & |\,8754 \\ \text{of } 1s.\ 8d. & \\ \text{and } 1s.\ 8d. = \frac{1}{12} & |\,1094\ 5d. \\ \hline & 91\ 3\ 9 \text{ as before.} \end{array}$$

Note. To discover what part of the price not divided for is of the price already found; set the price divided for, and that to be divided for in form of a mixt number, multiply the integral part by the denominator of the fractional, and divide the product by the numerator, and the quotient will be the new divisor to the last quotient. For instance, suppose the part last taken had been for 6*d.* and $\frac{2}{3}d.$ were to be divided for;

$$\begin{array}{r} 6\frac{2}{3} \\ \hline 2\,|\,18 \\ \hline 9 \text{ so } 9 \text{ is the next divisor.} \end{array}$$

OBSERVATION.

In calculating invoices and all accounts of that nature, it will be found convenient to calculate every article two different ways, for the agreement of the results is a proof that the work is right, and when the whole is finished there can in that case be no error but in the summation.

Or

Or 3. By dividing for the next even part, *viz.* 3*d.*

80) 8754

6) 109 8 6 at 3*d.* whereof $\frac{1}{2}=\frac{1}{8}$
18 4 9 at $\frac{1}{2}$

L. 91 3 9 remains for anſwer.

Note, At any price which is any even number of ſhillings, the value may be found by multiplying by the decimal of the price, and doubling the unit's place in the product for ſhillings.

Exam. 3. At 14*s.* what coſt 475*lb.*?

475
·7

L. 332 10 Anſwer.
475

237·5 = $\frac{1}{2}$
95 = $\frac{1}{5}$

332·5 = *L.* 332 10

Exam. 4. At 6*s.* 6$\frac{3}{4}$*d.* what coſt 494?

494
·3

12	148	4	0	at 6*s.*
8	12	7	0	at 6*d.*
	1	10	10$\frac{1}{2}$	at $\frac{3}{4}$.

L. 162 1 10$\frac{1}{2}$ at 6*s.* 6$\frac{3}{4}$*d.*

Caſe 4. If pounds are mentioned in the price, multiply for them; and if there are parts included in the quantity, reduce them to decimals, or take parts of the given price for them.

Exam.

Exam. 1. At 2*l.* 2¼*d.* what cost 325¼ *cwt.*

120) 325.25
2

8	650.50	at 2*l.*
	2.710416	at 2*d.*
	.338802	at ¼*d.*
	L. 653.549218	

Valued 653 10 11¾ Answer.

Exam. 2. If a dividend of 1*l.* 13*s.* 3*d.* is made upon 1*l.* of the stocks of a separating company, what will 526*l.* 10*s.* amount to?

2	526.5	= 1	0	0
4	263.25	= 0	10	0
5	65.8125	= 0	2	6
2	13.1625	= 0	0	6
	6.58125	= 0	0	3
	L.875.30625	L.1	13	3

Or, 526.5 = 20
236.25 = 10
87.75 = 3 4

877.5 at 33 4
Deduce 2.193 1 = $\frac{1}{40}$ of 3*s.* 4*d.*

875.306

Case 5. When there is a fraction in the given price, it may be entirely avoided in the computation, by multiplying the given price, and dividing the given quantity by the denominator of the fraction.

Exam.

Exam. 1. Required the cost of 1000 yards sailcloth at $9\frac{7}{8}d.$ *per* yard?

8) 1000	$9\frac{7}{8}$
125	79*d.* = 6*s.* 7*d.*

Therefore 125 at 6*s.* 7*d.*
·3

37	10	0	at 6*s.*
3	2	6	at 6*d.*
	10	5	at 1*d.*
L.41	2	11	at 6*s.* 7*d.*

For 1000 at $9\frac{7}{8}$

25	0	0	at 6*d.*
12	10	0	at 3*d.*
3	2	6	at $\frac{3}{4}$ or $\frac{1}{8}$.
	10	5	at $\frac{1}{8}$ or $\frac{1}{6}$ of $\frac{6}{8}$.
41	2	11	

Or, 40) 1000

2	25	6*d.*
4	12.5	3*d.*
6	3.125	$\frac{6}{8}$
	.521	$\frac{1}{8}$
	41.146	

Hence it is obvious that 125 yards at 6*s.* 7*d.* will cost just as much money as 1000 yards at $9\frac{7}{8}d.$ and the same kind of reason will hold good in every other instance.

Exam. 2. Required the value of 1260 yards of incle, at $1\frac{5}{12}d.$ *per* yard?

12)1260	$1\frac{5}{12}$
105	1*s.* 5*d.*

1	15	0	for 1*s.*
5	5	0	for 4*d.*
0	8	9	for 1*d.*
L.7	8	9	

Or

Or, 12) 1260

20) 105

3) 5·25
1·75
·4375

7·4375

In the preceding cases there will be found a sufficient number of examples for shewing the method of solving any question in the rule of proportion, when unity is one of the first terms, with the greatest expedition possible, that can be communicated in this way: At the same time I would recommend to the young arithmetician, to go over all these cases and examples again and again, till he not only be well acquainted with the method, but be able to do any of the examples quickly: nor content with that, he ought, and will find it to his account, to invent many more to himself, try them in different ways, to prove one another, and thereby be enabled to calculate invoices, bills of parcels, &c. for which these rules are particularly adapted, and which make up a great part of the business of computation in the counting-room, as hath been formerly observed.

VARIETIES IN PROPORTION.

INTRODUCTION.

SO extensive and various is the business of the counting-house, that it would be impossible, with any degree of propriety, to crowd it altogether into one general head; and therefore, to render the computations relative to the merchant, the banker, the insurer, the customhouse, &c. as practical and intelligible as possible, to each species of computation I have assigned a particular variety, in which the method of calculation is illustrated with proper examples; the nature of the transactions, which give rise to these computations, explained; the laws and regulations which regard the more critical parts of the mercantile business, pointed out; with every thing else that may serve to elucidate the different subjects that compose these varieties.

Variety I. TARE AND TRETT,

BY Tare and Trett, may be underſtood, any defect, waſte, or diminution in the weight, quantity, or quality of goods, by reaſon of certain circumſtances, for which a certain abatement is to be made by the ſeller to the byer, and is different in different merchandiſes, and in different countries. To have a more particular idea of the uſe and deſign of this variety, it will be proper to conſider, that,

In weighing ſeveral commodities, the weight of the package is included in the invoice weight of the goods, and the whole, upon that account, called *groſs weight*; the allowance for which is regulated either by cuſtom, or ſome expreſs ſtipulation betwixt the buyer and ſeller, and goes under the following denominations.

1. *Tare*, which is an allowance for the weight of the caſk, cheſt, box, &c. in which the goods are packed, and allowed to be either ſo much *per* bag, barrel, cheſt, &c, at ſo much *per cwt.* or at ſo much of the groſs weight, called *invoice tare.*

2. *Trett*, which is an allowance of 4 *lb. per* 104 *lb.* for duſt contracted by keeping, waſte by freight, carriage, &c.

When a deduction is made for the allowance of tare from the groſs weight, the remainder is called *nett*, unleſs trett is likewiſe allowed, when it is called *ſuttle*; and in that caſe the nett does not appear till $\frac{4}{104}$ or $\frac{1}{26}$ be ſubtracted from the ſuttle, and then the remainder gives the nett.

3. *Clough* is an allowance to the citizens of London, on ſome weighable goods, generally of *lb.* 2. *per* 336, or $\frac{1}{168}$ to turn the ſcale, or make good the weight, in caſe of ſhrinkage when the goods are weighed.

Theſe allowances may be taken off the groſs by ſeveral methods; but as it is no part of our deſign to dwell upon tedious ones, we ſhall illuſtrate the rule only by ſuch as ſeem moſt convenient for diſpatch.

Caſe 1. When the allowance is at ſo much *per* bag, barrel, cheſt, &c. the anſwer or nett is found by multiplication and ſubtraction, as in the following examples.

Queſt. 1. What is the nett weight of 40 hhds. of tobacco, weighing groſs 210 *cwt.* 3 *qrs.* tare 70 *lb. per* hhd.

lb.	*qrs.*	*lb.*	*hhds.*	210	3	groſs.
70 =	2	14 ×	40	25		tare to be deducted.
				185	3	nett weight.

3. What is the nett of 5 hhds. ſugar, content, groſs and tare as under?

	Groſs. C.	*qrs.*	*lbs.*		*Tare.*
No. 1.	15	3	17	——	111
2.	14	2	15	——	114
3.	16	1	19	——	110
4.	13	2	22	——	112
5.	15	1	11	——	119
	76	—		—	566
	76				
	76				
	76				

Groſs 8512—566 tare = 7946 nett.

4. Received 54 cheſts, weighing each 4 *cwt.* 2 *qrs.* 14 *lb.* allowance on each for tare, $45\frac{4}{9}$ *per lb.* what is the nett?
25518*lb.* Anſ.

5. Sold as under:

	Cwt.	*qrs.*	*lbs.*		*Tare.*
Hhds. of ſugar, No. 1.	14	3	15	——	109 *lbs.*
2.	15	2	17	——	113
3.	13	1	24	——	111
4.	12	0	27	——	108
5.	16	1	11	——	117
6.	15	2	18	——	107

At 51*s.* $6\frac{2}{3}$*d.* nett weight, what is the groſs, the tare, the nett, and the price?

	cwt.	*qrs.*	*lbs.*		*cwt.*		*cwt.*	*qrs.*	*lbs.*	
Nett	82	1	8.	Groſs	$88\frac{1}{4}$.	Tare	5	3	20.	Price L. 212 : 2 : 10.

6. A wine merchant imported 12 pipes Madeira wine, content 1512 gallons, and in paying the duties, was allowed 12 *per cent.*; for how many gallons did he pay the duties?
Anſ. $1330\frac{1}{2}$

7. Bought

7. Bought 780 bolls of victual at 12*s.* 9$\frac{3}{4}$*d.* but am allowed a boll to each score; how many bolls are payable, and what is the whole charge?

741 bolls at 12*s.* 9$\frac{3}{4}$*d.* =L.474 : 14 : 1$\frac{1}{2}$ Ans.

Case 2. When the allowance is at so much *per cwt.* the best way of finding the tare, is in general by aliquot parts; though sometimes the nett may readily be found by making 112 *lb.* the first term in a direct proportion, the difference betwixt the given tare and 112 the second, the given gross, the third; the fourth proportional will be the nett, without any subtraction.

Table of Aliquot Parts.

lb. *cwt.*	*lb.* *half cwt.*	*lb.* *qr.*	*qrs.* *cwt.*
16=$\frac{1}{7}$	8=$\frac{1}{7}$	7=$\frac{1}{4}$	2=$\frac{1}{2}$
14=$\frac{1}{8}$	7=$\frac{1}{8}$	4=$\frac{1}{7}$	3=$\frac{1}{2}$+$\frac{1}{2}$of$\frac{1}{2}$, &c.

Quest. 1. What is the nett weight of 256 *cwt.* 2 *qrs.* 19 *lb.* tare 14 *lb. per cwt.*

lb. 256.669 gross.
14 = $\frac{1}{8}$ = 32.083 tare to be deducted.

224.586 nett 224 *cwt.* 2 *qrs.* 9 *lb,* Answer.

Or thus,

lb. *lb.* *lb.*
112 : 112—14 : : 256.669 : 224.586 as before.

Quest. 2. What is the nett of 410 *cwt.* 2 *qrs.* 12 *lbs.* at 20 *lb. per cwt.*?

410 2 12 gross

lb.
16=$\frac{1}{7}$= 58 2 17$\frac{3}{4}$
4=$\frac{1}{4}$ of$\frac{1}{7}$=14 2 18$\frac{1}{4}$

20= 73 1 8 tare to be deducted.

337 1 4

lb. *lb.* *lb.* *cwt.* *gross* *cwt.* *nett.*
Or 112 : 112—20 : : 410 2 12 : 337 1 4

Note.

Note, In cases of this kind the most minute exactness is not required; for merchants, instead of subdividing the *lbs.* for the tare, take the nearest quarter of a *lb.* as in the last example, for sufficient exactness.

Quest. 3. At 10 *lb. per cwt.* tare, what is the of 410 *cwt.* 2 *qrs.* 12 *lb.* gross?

	cwt.	*qrs.*	*lbs.*	
	2) 410	2	12	gross.
	205	1	6	reduced to half *cwts.* of which 8 *lb.* $=\frac{1}{14}$, and $2\times7=14$.
lb.				
$8=\frac{1}{7}=$	29	1	9	
$2=\frac{1}{4}=$ of $\frac{1}{7}=$	7	1	9	
	36	2	18	tare to be deducted.
	373	3	22	nett.

Case 3. When tare and trett are both to be allowed, find and divide the tare as in the last case, the remainder will be the suttle, $\frac{1}{26}$, of which is always the trett; and when that is taken from the suttle, the remainder is the nett weight.

Quest. 2. In 732 *cwt.* 1 *qr.* 21 *lb.* gross packed in 57 butts, tare 19 *lb. per* butt, and trett 4 *per* 104 *lb.* how many *cwt.* nett?

Butts. *lb*
57 × 19 =

752·4375	gross
9·67	tare to be deducted.
$\frac{1}{26}$ 722·7675	suttle.
27·798	trett to be deducted.
694·969 = 694 *cwt.* 3 *qrs.* 24. *lb.* nett.	

Quest. 1. What is the nett of 375 *cwt.* 1 *qr.* 15 *lb.* tare 13 *lb.* *per cwt.* trett 4 *per* 104?

2) 375 1 15 gross.

187 2 $21\frac{1}{2}$ Reduced to half *cwts.* of which,

lb.				
$8=\frac{1}{7}=$	26	3	7	added.
$4=\frac{1}{2}$ of $\frac{1}{7}=$	13	1	18	
$1=\frac{1}{4}$ of $\frac{1}{2}=$ of $\frac{1}{7}=$	3	1	11	
	43	2	8	tare to be deducted.
26)	331	3	7	suttle.
	12	3	1	trett.
	319	0	6	nett.

3. What is the nett of 836 *cwt.* 2 *qrs.* 17 *lb.* gross, tare 22, trett 4 *per* 104?

646 *cwt.* 1 *qr.* 23 *lb.* Answer.

4. What is the nett of 346 *cwt.* 3 *qrs.* 12 *lb.* gross, tare 12 *per cwt.* trett 4 *per* 104, and what will the commodity amount to, at *L.* 8 : 6 : 2 *per cwt.*?

Answer 288 *cwt.* 2 *qrs.* 8 *lb.* = *L.* 2397 : 10 : $11\frac{1}{2}$.

Variety II. COMPUTATION of CUSTOMS, BOUNTIES, &c.

CUSTOMS are certain duties or tolls, imposed by the sovereign, or legislative power of the nation, on certain imports and exports, for the maintenance and support of government, receivable at the custom-house, and regulated by tariffs, or books of rates; the principal whereof may be reckoned tonnage, poundage, old subsidy, new subsidy, $\frac{1}{3}$, $\frac{2}{3}$ subsidy, &c.

Bounties are certain premiums allowed for the exportation of certain British manufactures.

Drawbacks are certain duties, either of the customs, or of the excise, for British manufactures that have paid duty to the excise or certain foreign merchandises, that have paid duty at importation.

EXAMPLES.

EXAMPLES.

The computation of duties may be reduced to the following cases.

I. *Nett subsidy of tonnage on wines imported.*

Exam. Two casks 9 *cwt.* 1 ton Spanish wine, imported into the port of London, by British, and in a British ship, from the place of its growth.

filled.			*unfilled.*		
L. 4	10	gross duty *per* ton,	L. 4	10	0
		12 *per cent.* for leakage,	0	10	$9\frac{12}{20}$
4	10		3	19	$2\frac{8}{20}$
	9	off 10 *per cent.* of the gross duty,		9	
4	1	nett, - - -	3	10	$2\frac{2}{5}$

III. *Additional duty.*

Exam. 1. Two casks contain 1 ton Spanish wine, by British or strangers in British or foreign ships, when duty paid.

filled.			*unfilled.*		
L. 4	0	gross additional duty *per* ton,	L. 4	0	7
———		off 12 *per cent.* for leakage, -	0	9	$7\frac{1}{5}$
4	0	remains, - - -	3	10	$4\frac{4}{5}$
0	6	off $7\frac{1}{2}$ *per cent.* for prompt payment,	0	5	$3\frac{2}{5}$
3	14	remains, - - -	3	5	$1\frac{2}{5}$
0	8	off 10 *per cent.* of the gross duty,	0	8	0
3	6	nett to be paid,	2	17	$1\frac{2}{5}$

When duty secured.

L. 4	0	gross additional duty, - -	L. 4	0	0
———		off 12 *per cent.* for leakage, - -	0	9	$7\frac{2}{5}$
4	0	remains, - - - -	3	10	$4\frac{4}{5}$
0	8	off 10 *per cent.* of the gross duty,	0	8	0
3	12	remains nett to be secured, -	3	2	$4\frac{4}{5}$

Exam.

Exam. 2. 1200 British plantation tobacco.

paid.			*secured*		
L.5 0	gross additional duty at 5 *per cent.*	-	L. 5	0	0
1 5	discount at 25 *per cent.*—at 15 *per cent.*		0	15	0
3 15	to be paid nett. To be secured nett,		4	5	0

3. What duty must be paid on the importation of 20 puncheons containing 2000 gallons of rum at 4*d.* $\frac{4}{5}$ and $\frac{1}{21}$ of $\frac{1}{20}$ duty, and 4*s.* 8*d. per* gallon excise?

1st, For the duty.			2d, For the excise.	
60	2000		5	2000
8	33.333 for 4*d.*		6	400 for 4*s.*
2	4.166 for $\frac{10}{20}$			66 13 4 for 8*d.*
5	2.083 for $\frac{5}{20}$			
21	.416 for $\frac{1}{20}$			466 13 4 excise.
	.019 for $\frac{1}{21}$			40 0 $5\frac{1}{2}$ duty.
	Duty 40.022=L.40:0:$5\frac{1}{2}$			L.506 13 $9\frac{1}{2}$ total.

4. What would be the nett duty on 12453 *lbs.* of tobacco, were the duty reduced to the rate of 6*d.* $\frac{4}{20}$ and $\frac{2}{3}$ of $\frac{1}{20}$ *per lb.*

40	12453	
30)	311.325	for 6*d.*
6)	10.3775	for $\frac{4}{20}$
	1.7296	for $\frac{2}{3}$
	323.432=L.323:8:$7\frac{1}{2}$	

5. What duty must be paid on the importation of 20 pipes Port wine filled in casks at L.28:8:$3\frac{2}{20}$ and $\frac{4}{5}$ of $\frac{1}{20}$ *per* ton?

Answer, L.284:2:$7\frac{1}{2}$

6. What duty must be paid on the importation of 35 pipes French wine at L.59:17:$5\frac{5}{20}$ and $\frac{4}{5}$ of $\frac{1}{20}$?

Answer, L.1047:15:$2\frac{1}{4}$.

6. What

7. What duty must be paid on the importation of 2374 ells Silesia linen at the rate of 43| $5\frac{13}{20}$ and $\frac{1}{2}$ of $\frac{1}{20}$ *per* long hundred or 120 ells? Answer, *L*.43:0:0$\frac{1}{4}$.

Variety III.

RULE OF MIXTURES.

IN groceries they sometimes mix several sorts of their wares together, for the convenience of sale, and to proportion the price of the mixture to the several prices of the simples, or to find the quantity of each ingredient, which will proportion the mixture to a certain price, will admit of the following cases.

Case 1. When the quantity of each ingredient is the same, the several rates *per lb. oz. cwt.* &c. added together, and their sum divided by the number of quantities, will give the rate of the mixture.

Example. A grocer would mix sugar at 50*s. per cwt.* 60*s. per cwt.* and at 70*s. per cwt.*; what is 1 *cwt.* of the mixture worth?

$$\begin{array}{r} 50 \\ 60 \\ 70 \\ \hline 3)\,180 \\ \hline 60s. \text{ Answer.} \end{array}$$

Case 2. When the quantities as well as the prices are different, find the several values according to the different rates and quantities, and divide the sum of their values by the sum of the quantities; the quotient gives the answer.

Exam. 1. If 278 gallons of rum at 11*s.* 6*d. per* gallon, were mixed with 174 gallons at 9*s.* 3*d. per* gallon, what would a gallon of the mixture be worth?

278	174
11	$9\frac{1}{4}$
3058	1566
139	$43\frac{1}{2}$
3197	$1609\frac{1}{2}$
$1609\frac{1}{2}$	

$278+174=452)4806\frac{1}{2}($10*s.* $7\frac{1}{2}$*d.*

452
286
12
3438
3164
274
4
1096
904
192

Exam. 4. A goldsmith or refiner hath 12 *oz.* of gold at *L.* 4 *per oz.* 8 *oz.* at *L.*4, 5 *s. per oz.* 3 *oz.* at *L.*4 : 6 : 8 *per oz.* and 9 *oz.* at *L.*4 : 13 : 4 *per oz.*; if these were all melted down together, what would an ounce of the composition be worth ?

12×4	0	0=	*L.*48
8×4	5	0=	34
3×4	6	8=	13
9×4	13	4=	42
32			8)137
			4) 17 2 6
			L. 4 5 $7\frac{1}{2}$ Answer.

Case 3. To increase or diminish a compound proportionally, by knowing the several quantities of the simples in the composition.

RULE.

As the sum of the particular quantities of the compound given is to the whole quantity proposed to be increased or diminished, so is each particular quantity in the given compound, to the due proportion required of that specie, fineness, *&c.*

Example. Let the compound in the last question be increased to 48 oz. how much must be taken of each simple ingredient?

32 : 48 ::	12	18	at	L.4	0	0
32 : 48 ::	8	12	at	4	5	0
32 : 48 ::	3	$4\frac{1}{2}$	at	4	6	8
32 : 48 ::	9	$13\frac{1}{2}$	at	4	13	4.
		48				

Case 4. Having the simples of any compound given, to find how much of any simple ingredient is in any part of that composition.

RULE.

As the total of the composition is to the quantity of any simple in that composition, so is the total quantity proposed to be proportionally compounded, to the quantity of each simple to be in that proposed quantity.

Example. It is required to find out how much of each ingredient is in a pound weight of gold, or 12 ounces, at the prices mentioned in the last example, when there are 32 ounces in the composition.

32 : 12 or 8 : 3 ::	12 : $4\frac{1}{2}$	at	L.4	0	0
8 : 3 ::	8 : 3	at	4	5	0
8 : 3 ::	3 : $1\frac{1}{8}$	at	4	6	8
8 : 3 ::	9 : $3\frac{3}{8}$	at	4	13	4
	12				

Case 5. The total of the compound of two simples, with the total value of that composition, and the value of an unit of each simple being given, to find the quantity of each simple ingredient in the composition.

RULE.

RULE.

Multiply the total quantity of the composition by the lesser price of the unit, deduct the product from the total value of the composition, and divide the remainder by the difference in value of an unit of the two simples given, and the quotient is the quantity of the higher priced simple, whose complement to the total of the compound gives the other quantity.

Example. Suppose there are 20 ounces of gold melted into one mass, consisting of gold at *L.*4 *per oz.* and gold at *L.* 4, 5*s. per oz.* the value of the whole being *L.*82; it is required to find how much of each was taken to make the composition?

oz.
20=*L.*82
4=1 *oz.* of the lesser price,
—
80
82
—
Diff. of an unit 5*s.*=25) 2 the difference,
—
8 *oz.* of the higher price=34 }
20 the whole composition= } *L.* 82
—
Diff. 12 *oz.* of the lower price=48 }

DEMONSTRATION.

Let T represent the total quantity of the mixture here, 20 *oz.* of gold, and let V represent the total value of the said mixture=*L.* 82; let P=*L.* 4, 5 *s.* the price of an unit of the dearest simple, and p= the price of an unit of the cheapest simple; a= the quantity of the first, e= the quantity of the second. Then $a+e=\mathrm{T}$ *per* question, and $e=\mathrm{T}-a$; by multiplying each quantity by the respective price of an unit, it will be $a\mathrm{P}$= the value of the dearest part of the composition, and $\mathrm{T}pa-p$= the value of the cheapest part; and consequently the sum of both $a\mathrm{P}+\mathrm{T}p-ap=\mathrm{V}$ the total value: and by subtracting $\mathrm{T}p$, it will be $a\mathrm{P}-ap=\mathrm{V}-\mathrm{T}p$; and dividing both sides by the coefficients of a, we find $a=\dfrac{V-Tp}{P-p}$. Q. E. D.

Variety

Variety IV. Warehouſe and ſhop-computations of Loſs and Gain.

IN buying and ſelling, it is not only neceſſary for a merchant to be a perfect judge of the quality of goods, and to be well acquainted with propereſt markets for making the beſt purchaſes and quickeſt ſales, but he muſt likewiſe be able, by comparing both together, on the different articles in which he deals, to make a true eſtimate of his trade, thereby to judge with certainty, in what articles he ought to launch out, and in what to retrench, as he finds them more or leſs to his account. To effectuate this, it was found neceſſary to have ſome common ſtandard, by which the gain or loſs made, or propoſed to be made upon any commodity, or article in trade, ſhould be tried and expreſſed; aad this, by univerſal conſent, ſeems to have been fixed to the *centum* or hundred; ſo that when we ſay the gain is at 10 *per cent.* it is to be underſtood, that when 100*l.* 100 guineas, 100 crowns, 100 ſhillings, &c. have been laid out in purchaſing goods, 110*l.* 110 guineas, 110 crowns, 110 ſhillings. &c. have been recovered by the ſales; and, in the ſame manner, if 100*l* &c. were laid out on the purchaſe of goods, and but 90*l.* received back, we would ſay that 10 *per cent.* was loſt by ſuch goods.

This variety will admit of four caſes.

Caſe. When the buying and ſelling prices are known, and the rate *per cent.* gain or loſs required.

RULE.

As the buying price is to the difference betwixt the buying and the ſelling price, ſo is 100 to the gain or loſs *per cent.*

Exam. 1. Bought cloth at 15*s.* 6*d.* and ſold it again for 18*s.* what did I gain *per cent.* ?

6*d.* 6*d.* 6*d.* 6*d.* 6*d.*

$31 : 36-31=5 :: 100 : 16\frac{4}{31}$ *per cent.*

For 31) 500

$16\frac{4}{31}$. Anſwer.

Hence had 100 ſixpences been laid out on cloth at 15*s.* 6*d.* which was ſold again for 18*s.* there would have been gained $16\frac{4}{31}$ ſixpences; if 100 ſhillings, the gain would have been $16\frac{4}{31}$ ſhillings; and if 100 pounds, the gain would have been $16\frac{4}{31}$ pounds, &c.; for the proportion would ſtill have been the ſame, as will be evident from the laſt example performed the common way.

```
 15 6      2 6       L. 100
 12        12           240
 ----      ----      -------
 186d.     30d.  ::   24000
                         30
                     ------- 12
               186) 720000 (3870
                    588    ------
                    -------2|0)32|2 6
                    1620
                    1488      16 2 16¾=16 4/31
                    -------
                     1320
                     1302
                    -------
                      180
```

Exam. 2. Bought cloth for 10*s.* and sold it again for 9*s.* what did I lose *per cent.*?

```
10) 100
    ----
```

10 *per cent.*; for 10 : 1 :: 100 : 10.

Exam. 3. Bought a puncheon of rum for 66*l.* 13*s.* 4*d.*; it runs 150 gallons, which I retailed at 12*s.* 6*d.* *per* gallon; whether did I gain or lose, how much, and at what *per cent.*?

3)

2) 150 gallons.

4) 75 0 at 10*s*.
18 15 at 2*s*. 6*d*.

93 15 0 selling price.
66 12 4 buying price.

2 : 27 1 8 :: 3
3

2) 81 5 0

40 12 6 *per cent.*

Because 66*l*. 13*s*. 4*d*. is just $\frac{2}{3}$ of 100*l*. 2 is made the first term; and because $\frac{3}{3}$=100*l*. 3 is made the last term; so by the answer there is gained 27*l*. 1*s*. 8*d*. which is $40\frac{5}{8}$ *per cent*.

4. If 2*d*. on the shilling be a retailer's profit, what has he *per cent.*? Answer, $16\frac{2}{3}$.

5. Suppose he retails to the amount of *L*.5000 a year, what is his annual gain? Answer, *L*.833:13:4.

R U L E.

100 in this case will be the first term, the rate added to 100 the second, and the buying price the third, the fourth proportional to which is the advanced price required.

Exam. 1. Bought cloth at 15*s*. *per* yard, how may I charge it *per* yard, to gain 25 *per cent.*?

s. s. s. s. d.
100 : 125 :: 15 : 18 9
For abridging the terms 3

20) 375

18 9. Answer.

Exam.

Exam. 2. Bought 400 ſpindles of yarn for *L.*41, carriage and other charges came to 17*s.*; how may I retail it *per* ſpindle, to clear 30 *per cent.*

$$\begin{array}{c} \qquad\qquad\qquad L. \quad s. \; d. \\ 400 : 13 :: 41.85 : 2 \; 7\tfrac{5}{8} \\ 13 \\ \hline 4)\,.54405 \\ \hline .13601 = 2s.\ 8\tfrac{5}{8}d.\ \textit{per}\ \text{ſpindle.} \end{array}$$

Exam. 3. Bought 17 *cwt.* 3 *qrs.* of ſugar at 60*s.* and 14 *cwt.* 2 *qrs.* and 14 *lb.* at 70*s* which I mixed together, and propoſe to ſell at 30 *per cent.* advance; how may I value one *cwt.* of the mixture to effectuate my purpoſe?

$$\begin{array}{lll} & & L. \\ \text{First,} & 17.75 \times 3 = & 53.25 \\ & 14.625 \times 3\tfrac{1}{2} = & 51.1875 \\ \hline \text{Quantity} & 32.375 & 104.4375 \text{ prime coſt} \\ & & 13 \end{array}$$

$$\begin{array}{r} \hline \qquad\qquad\qquad\qquad\qquad L.\ s.\ d. \\ 323.75)1357.6875(4.19136 = 4\ 3\ 10\tfrac{1}{4} \\ 129500 \\ \hline 62687 \\ 32375 \\ \hline 303125 \\ 291375 \\ \hline 117500 \\ 97125 \\ \hline 203750 \end{array}$$

4. Bought

4. Bought at 1*s*. and would sell again at $12\frac{1}{2}$ *per cent.*; what must I charge? Answer, 1*s*. $1\frac{1}{2}$*d*.

5. Bought goods to the value of *L*. 374, 15*s*. but coming to a bad market, I would willingly lose 25 *per cent*, what should I recover in that case? Answer, *L*. 281 : 1 : 3.

RULE.

The lowest advanced price will be the first term, the rate added to 100 will be the 2d, the highest advanced price the 3d, and 4th proportional will be the advanced price required, after 100 is deduced from it.

Exam. 1. Sold tobacco at 7*d*. *per lb*. upon which I had 10 *per cent*. markets rose to 8*d*.; what did that advance bring *per cent.*?

$$7d. : 110 :: 8 : 125\tfrac{5}{7}$$
$$\begin{array}{r} 110 \\ \hline 7)\,880 \\ \hline 125\tfrac{5}{7} \\ 100 \\ \hline \end{array}$$

$25\frac{5}{7}$ *per cent*. Answer.

Exam. 2. Sold cloth at 18*s*. upon which I had 15 *per cent*. how much *per cent*. had my neighbour, who sold his cloth of the same cost at 19*s*. 6*d*.? Answer, $24\frac{1}{2}$ *per cent*.

Case 4. If the prime cost is required, 100 added to the rate *per cent*. will be the first term, 100 the second, the advanced price the third, and the fourth proportional the prime cost required.

Exam. 1. Sold a pipe of wine for *L*. 43, 15*s*. by which I had 20 *per cent*. what was the prime cost?

					L.		L.	s.	d.
	120	:	100	::	43·75	:	36	9	2
Abridged	6	:	5	::	43·75				

$$\begin{array}{r} 43{\cdot}75 \\ 5 \\ \hline 6)\,218.75 \\ \hline 36{\cdot}4583 = L.\,36\ \ 9\ \ 2 \end{array}$$

Exam.

Exam. 2. Sold 50 pieces Scots lawns, 10 yards each, for *L.* 135; by which I had 15 *per cent.* what did it cost me *per* yard?

115×500 : 100 :: 135 : 4*s.* $8\frac{1}{4}$*d.*
Abridged 115 : 1 :: 27
20
---
s. d.
540 (4 $8\frac{1}{4}$
460

80
12

960
920

40
4

160
115

45

3. Sold tobacco at $6\frac{2}{3}$*d. per lb.* by which I had $5\frac{1}{2}$ *per. cent.* but markets rising, I sold what remained at $7\frac{1}{2}$*d. per lb.*; what is the difference *per cent.*? Answer, $6\frac{1}{5}$.

4. Sold a parcel of goods for 457*l.* 9*s.* by which I cleared 18 *per cent.*; the purchaser sold them immediately for 500*l.*; how much *per cent.* would I have cleared had I come to the same market? Answer, 29 *per cent.* nearly.

5. Sold my cloth at 13*s.* by which I had $12\frac{1}{2}$ *per cent.* my neighbours sold the same cloth at 14*s.*; what had they *per cent.*? Answer, 21.

OBSERVATION.

In selling on credit, merchants generally propose a certain profit, which they calculate upon the prime cost of the goods, added to the real and imaginary charges.—The real charges on goods are freight, insurance, lighterage, porterage, wareroom rent, &c. and the imaginary

ginary charges or risk of bad debts, dilatory payments, short insurance, possible accidents in the carriage, risk of having them long on hand, &c.; and where this calculation is made according to the profit they propose, the goods are marked on the cover with something characteristical of the price, which is known only to those concerned in the shop or ware-room. After all, merchants are frequently obliged to conform themselves to the market, selling under the rate they proposed, when there are few bidders, and as demands rise, taking the best price they can get.

Variety V. COMPUTATIONS IN BARTER.

BARTER is the commutation of one commodity for another, and teacheth so to proportion the quantities to be exchanged, according to the conditions of the barter, that neither party may sustain loss. Questions of this kind may be quickly resolved by one single operation, by the following

RULE.

Let the rate of the assigned quantity *per* yard, *lb. cwt.* &c. be put for the first term, the given or assigned quantity for the second term, and the rate of the quantity required for the third term, in a reciprocal proportion, then will the fourth proportional be the answer.

Exam. 1. How many yards of shalloon may I have in barter for 80 yards of broad cloth, rating the broad cloth at 15*s.* 6*d.* and the shalloon at 2*s.*?

6d. *yds.* *6d.* *yds.*
31 : 80 :: 4 : 620
31

4) 2480

620 *yds.*

Or $\frac{80}{4} = 20 \times 31 = 620$ yards of shalloon as before.

Exam.

Exam. 2. How many yards of Irish linen at 2*s*. 3*d*. may I have in barter for 80 pieces holland of 20 yards each, at 3*s*. 6*d*. *per* yard?

$$
\begin{array}{rcl}
\text{3ds.} & & \text{3ds} \\
114 : 80\times20 & :: & 9 : 2488\tfrac{8}{9}
\end{array}
$$

$$
\begin{array}{rr}
\text{For} & 80 \\
 & 20 \\
\hline
 & 1600 \\
 & 14 \\
\hline
9) & 22400 \\
\hline
 & 2488\tfrac{8}{9}
\end{array}
$$

Exam. 3. How many pieces of India chintz may I have in barter for 86 pieces of broad cloth, rating the former at *L.* 25, 10*s*. and the latter at *L.* 15, 15*s*.?

$$
\begin{array}{l}
\text{15s. } \textit{pieces.} \text{ 15s.} \\
21 : 86 :: 34 : 53\tfrac{2}{17}
\end{array}
$$

$$
\begin{array}{rr}
\text{For} & 86 \\
 & 21 \\
\hline
 & 172 \\
34) & 1806\,(53 \\
 & 170 \\
\hline
 & 106 \\
 & 102 \\
\hline
 & 4 \\
\hline
 & 34 = \tfrac{2}{17}
\end{array}
$$

Variety VI. Computations in Partnership.

WHEN two or more merchants join together to carry on any branch of business, they are said to be in partnership or company; and if their stocks are equal, the gain, loss, or proceeds that each partner may sustain, or draw from the concern, is found by dividing either by the number of partners; when their different shares of the capital have one common denominator, their respective shares of gain, loss, or proceeds, are found by multiplying the gain, loss, or proceeds, by their respective numerators, and dividing the product by the common denominator. When each partner puts in a certain sum, as best suits his inclination or abilities, his share of gain, loss, or proceeds must be proportioned to his stock. And, lastly, when the partners not only put into the company trade different stocks, but enter or withdraw these stocks at different periods, and perhaps both each partner's share of gain, loss, or proceeds must be proportioned to his share of the capital, and the time it was employed. Hence will arise four cases,

Case. 1. When the capital is divided into equal shares, each partner's dividend of the gain, loss, or nett proceeds is found, by dividing the whole gain, loss, or nett proceeds by the number of partners.

Exam. A. B. and C had each in the common stock *L*. 500; when their books were balanced, they found there was of nett gain *L*. 550; how much must be carried to each partner's account in company?

3) 550

L. 183 6 8 Answer.

2. Four partners were equally concerned in trade, *viz*. A. B, C, and D. D was manager, and when he exhibited his balance sheet at the end of the year, there was found of clear gain, L. 4785 : 16; how much has each to draw, the manager, besides his share of gain, being allowed L. 100 a year.

4785	16	
100		to D for management.
4) 4685	16	nett profit.
1171	9	due to each.

3. Three

3. Three partner's were equally in advance, but one had L. 100 *per ann.* for management. At balancing their books at the end of two years, they found there would be a dividend of 2784 : 15, what will be due to each, after an allowance for management

Anſwer, L. 861 : 11 : 8.

Caſe. 2. When the different ſhares of the capital have one common denominator, divide the gain, loſs, or proceeds by that denominator, and multiply the quotient by their reſpective numerators.

Exam. A, B C and D were concerned in a ſtore in Virginia, whereof A had $\frac{1}{2}$, and B, C and D each $\frac{1}{6}$; when the ſtore was ſold off, and the debts collected, there was a clear capital of L. 5000; what is the dividend to each?

6) 5000

833 6 8 to B.
833 6 8 to C.
833 6 8 to D.
2500 0 0 to A.

5000 0 0 as given.

2. A trading company have a capital of *L.* 96745 : 16 : 8, which is divided into 64 ſhares what is A B's intereſt who holds 5 ſhares?

Anſwer, *L.* 7558 : 5 : $4\frac{3}{8}$.

3. A trading company have of capital ſtock *L.* 236574 17*s.* 6*d.* which is divided into 156 ſhares: what is A's intereſt in the company, who holds 19 ſhares?

Anſwer, *L.* 28813 : 12 : 8 nearly.

Caſe. 3. When each partner ſtocks in a ſum at random, as ſuits his convenience or inclination; let the whole capital be the firſt term, the proceeds, gain, or loſs, the ſecond, and each partner's ſtock the third; then will the ſhare of gain, loſs, or proceeds, due to that partner whoſe ſhare of the capital was the third term, be the fourth proportional.

Exam. 1. A, B and C freight a ſhip to Jamaica; A puts in goods to the value of *L.* 475, 10*s.* B to the value of *L.* 675, : 3 : 4, and C to the value of *L.* 834 : 6 : 8, including charges; they gained *L.* 547, 19*s.* on the voyage; what is the dividend to each, in proportion to his ſhare of the capital?

A=

	L.	*s.*	*d.*
A=	475	10	0
B=	675	3	4
C=	834	6	8

Capital 1985 0 0 : 547·95 gain.
Abridged 397 0 0 : 109·59 : : $475\frac{1}{2}$: 131.259=A,
397 0 0 : 109·59 : : $675\frac{2}{3}$: 186.376=B,
397 0 0 : 109,59 : : $834\frac{1}{3}$: 230.315=C.

547·95 proof

Sometimes the anſwer can be found more expeditiouſly, by finding the ſhare of gain, loſs, or proceeds due to *L.* 100, and performing the reſt of the operation by practice, eſpecially where there are few fractions.

Exam. 2. A, B and C freight a ſhip to Virginia; A contributed to the adventure *L.*500, B *L.*1200, and C *L.*1300; they had returns in tobacco, the nett proceeds whereof amounted to *L.* 3800; what is the dividend to each?

First, 3000 : 3800 : : 100
Abridged 3 : 38 : : 10
10

3) 380

126 13 4 *per cent.*
5

500 = 633	6	8	A draws	633	6	8
500 = 633	6	8				
200 = 253	6	8	B draws	1520	0	0
1200 = 1520	0	0				
100 = 126	13	4	C draws	1646	13	4
			Proof	3800	0	0

It

It will have the same effect, and sometimes the process will be still shorter, to find the proportional share of gain, loss, or proceeds, to *L.* 1, and do the rest by practice.

Exam 3. A, B and C fit out a ship for Martinico, for which they pay their 300 guineas each. A puts into the common stock, for the purchase of ready-money goods, *L.*274, B *L.*389, and C *L.* 437. Moreover, they buy upon their joint credit goods at twelve months, to the amount of *L.* 2750: porterage, lighterage, packing and shipping charges were paid out of the ready money.— A goes supercargo, and is allowed $2\frac{1}{2}$ *per cent.* proceeds for his trouble of management. Each partner's share of nett proceeds for the ready money advanced was to be proportioned to his inputs, but for the goods on credit they shared equally.—A arrives with a bill of exchange for *L.* 1000, and sugar, which, after all charges were deducted, they sold for *L.* 4785. A's bill of charges and commission came to *L.* 360; how will the remainder be divided?

Advanced by A. in cash		*L.*274	Returns in sugar	*L.*4785
Ditto by B.	-	389	In a bill of exchange	1000
Ditto by C.	437	437		——
		——	Total returns -	5875
Total advances in money		1100	Deduct charges, &c.	360
Upon the common credit		2750		——
		——	Nett proceeds	L.5425
Total of the capital		3850		

To find the dividend upon L.1, it will be

cap.		*proceeds.*		*cap.*
3850	:	5425	: :	1

Abridged 154 : 217 : : 1 L. 1 8 $2\frac{2}{11}$.

Since A put in *L.*274

	——		
For 1*l.* he draws	274	0	0
For 6*s.* $8\frac{1}{3}$*d.*	91	6	8
For 1*s.* $4\frac{1}{5}$*d.*	18	5	4
For $1\frac{1}{8}$*d.*	2	5	8
For $\frac{2}{11}$, $\frac{1}{11}$	0	4	$1\frac{1}{4}$

Note, These methods prove each other alternately.

Note, The ship makes no alteration, unless it had been sold at loss or profit.

For 154 : 217 : : 274 : A's share, *L.*386 1 $9\frac{1}{4}$.

A's share

A's ſhare brought forward,				L.386	1	$9\frac{1}{4}$
Since B. put in	L. 389	0	0			
$\frac{1}{3}$ =	129	13	0			
$\frac{1}{5}$ =	25	18	8			
$\frac{1}{8}$ =	3	4	10			
$\frac{1}{11}$ =	0	5	$10\frac{3}{4}$			
For 154 : 217 : : 389 : B's ſhare,				L.548	2	$8\frac{1}{4}$
And ſince C put in	L. 437	0	0			
$\frac{1}{3}$ =	145	13	4			
$\frac{1}{5}$ =	29	2	8			
$\frac{1}{8}$ =	3	12	10			
$\frac{1}{11}$ =	0	6	$7\frac{3}{4}$			
For 154 : 217 : : 437 : C's ſhare,				L.615	15	$5\frac{3}{4}$
Laſtly, 154 : 217 : : 1100 :				L.1550	0	0

ready money proceeds.

From the total proceeds	L.5425
Deduct - - -	1550
Remains - -	3857
Deduct goods on credit -	2750
	1125

To be divided equally $\frac{1}{3}$ to each L. 375, which being added to their ready-money ſhares reſpectively, gives the particular ſum which each partner draws out of the concern.

In real partnerſhip there are few inſtances where the ſhares of the company's capital are ſo undetermined as in ſome of the laſt examples; if they are not determined by one common denominator, they are generally even hundreds; or if one advance more than another, the difference is made up by an intereſt account, at balancing the books. But this caſe is of ſingular uſe in ſettling compoſitions in bankruptcy, and average loſſes in inſurance, to which we refer.

Caſe

Case 4. When the partners give in or withdraw their stocks at different periods, multiply each partner's stock into the time it was employed, and the sum of the products will be the first term; the gain, loss, or proceeds the second; and each particular product the third; then will the fourth proportional be the share of gain, loss, or proceeds due to that partner, the product of whose money and time was the third term. Or the proportional share of gain may be found to 1*l.* as above, and the rest performed by practice or multiplication, as seems most convenient for dispatch.

1. A and B trade in company; A employed in the company trade *L.* 1259 from the 1st of January to the end of the year, but B could advance nothing till the 1st of May, how much must he advance then, to give him an equal interest with A at the year's end?

Answer, *L.* 1888 : 10.

2. A, B and C butchers, have a pasture at *L.* 24 : A had 40 cows on it for 4 months, B 30 cows for 2 months, and C 36 for 5 months; what proportion of the rent falls to each?

Answer, A pays	*L.* 9	12	}	*L.* 24
B pays	3	12		
C pays	10	16		

Variety VII. Bankruptcy, and Computations relating to Compositions.

BANKRUPTCY is the failure, absconding, and relinquishment of traffic in a merchant, banker, or any other trader.—In the first ages of banking, the dealers in exchange had benches erected in the public places, upon which they told their money, and wrote their bills, &c. as the itinerant merchants or chapmen have at this day.—When a banker failed in his circumstances, his bench was broke, either to denote a fraud, or advertise the public, that the person to whom the bench belonged was no longer to be trusted; hence the term *bankruptcy* is of Italian extraction, from two words signifying a *broken bench.*

The computations relating to this variety, when there are few creditors, may be made as in case 3. of the last variety.

Exam. 1. Suppose a bankrupt's effects would amount to 1739*l.* 13*s.* 8½*d.* what dividend thereof will fall to each of the following creditors in proportion to their respective sums?

He owes	to A,	L.313	7	3	=313.3625
	to B,	290	4	6	=290.225
	to C,	700	0	0	=700.
	to D,	486	13	8	=486.68333
	to E,	600	0	0	=600.
	to F,	500	0	0	=500.
	to G,	381	10	0	=381.5
	to H,	418	0	6	=418.
Total debt,		L.3689	15	5	=3689.77083

Debt *Subject.*
368.77083 : 1739.685416 ::

		L.	s.	d.		
313.3625	:	147	14	$11\frac{1}{4}$	A	draws.
290.225	:	136	16	$9\frac{1}{4}$	B	
700.	:	330	0	10	C	
486.683	:	229	9	$8\frac{3}{4}$	D	
600.	:	282	17	$10\frac{1}{4}$	E	
500.	:	235	14	$10\frac{1}{2}$	F	
381.5	:	179	17	$5\frac{1}{2}$	G	
418.	:	197	1	8	H	
		L.1739	13	$8\frac{1}{2}$	Proof.	

By the above method it is plain, there must be an heavy multiplication and division for every creditor, which, when the creditors are numerous, would render the calculation intolerably tedious and troublesome, in which case, find the dividend for 1*l.* and do the rest by practice; or, which will be much shorter, multiply the dividend for 1*l.* into all the nine digits severally, and then into 10; multiply this last product into all the nine digits, and lastly into 10, so shall there be a table constructed, from which the several dividends, were the creditors ever so numerous, can easily be effected.

When the composition is agreed on, or fixed betwixt the failant and his creditors, the dividend may be at once calculated for any sum practically, without a table, especially if the parts can be easily taken.

Exam.

Exam. 2. A B breaks, and offers his creditors 15*s.* a pound, which they agreed to accept of; what will C receive whose debt amounts to L. 515 : 7 : 6?

2) 515	7	6		
2) 257	13	9	for	10*s.*
128	16	10½	for	5*s.*
386	10	7¼	for	15*s.*

Exam. 3. A B breaks, and offers his creditors 12*s.* 6*d.* a pound, which they agree to receive; what is C's debt worth, amounting to L. 756 : 19 : 6?

2) 756	19	6		
378	9	9	for	10*s.*
94	12	5¼	for	2*s.* 6*d.*
473	2	2¼		12*s.* 6*d.* Answer.

Exam. 4. A B compounds his debt with his creditors at 5*s.* 5*d.* per pound Sterling; what will C receive, to whom he was due L. 500?

4) 500				
12) 125	0	0	at	5*s.*
10	8	4	at	5*d.*
135	8	4		5*s.* 5*d.* Answer.

Variety VIII. STOCKJOBBING.

TO render this subject more intelligible, it hath been thought proper to divide it into particular sections.

Sect. I. *Of stocks, or transferable sums.*

By the word *stocks* was originally meant, a particular sum of money contributed for establishing a fund, to enable a company to carry on a certain trade, by means of which the person became a partner in that trade, and received a share of the profit made thereby in proportion to the money employed. But this term hath been

extended further, though improperly, to signify any sum of money which hath been lent to the government, on condition of receiving a certain interest, till the money is repaid, and which makes a part of the national debt. As the security, both of the government and of the public companies, is reckoned preferable to that of any private person, as the stock is negociable, and may be sold at any time, and as the interest is always punctually paid when it falls due; so they are thereby enabled to borrow money on a lower interest than what might be obtained from lending it to private persons, where there must be always some danger of losing both principal and interest.—But as every capital stock, or fund of a company, is raised for a particular purpose, and limited by Parliament to a certain sum, it necessarily follows, that when that fund is completed, no stock can be bought of the company; though shares already purchased may be transferred from one person to another. This being the case, there is frequently a great disproportion between the original value of the shares and what is given for them when transferred: for if there are more buyers than sellers, a person who is indifferent about selling, will not part with his share without a considerable profit to himself; and, on the contrary, if many are disposed to sell, and few purchasers appear, the value of stocks will naturally fall, in proportion to the impatience of those who want to turn their stock into specie.

SECT. II. *Computations in stockjobbing.*

Case 1. When the stock is any number of even hundreds, multiply the rate *per cent.* by the number of hundreds, and the product gives the price.

EXAMPLES.

1. Sold 500 three *per cent.* consolidated annuities, at $75\frac{5}{8}$; what does it amount to?

	75	12	6
			5
L	378	2	6 Answer.

Bought

2. Bought 700 India ftock, at $135\frac{3}{4}$ *per cent*; how much money muft I pay?

135	15
	7
950	5 Anfwer.

3. Sold 400 fcript. at $92\frac{1}{2}$, what ought I to receive?

92	10
	4
370	0 Anfwer.

Cafe 2. When the quantity of ftock bought or fold is no even number of hundreds, multiply the quantity by the rate *per cent*, and divide the product by 100, the quotient gives the anfwer.

EXAMPLES.

1. What muft I pay for 135 annuities $3\frac{1}{2}$, at $87\frac{1}{2}$ *per cent*?

$$\begin{array}{r} 87.5 \\ 135 \\ \hline 4375 \\ 11375 \\ \hline \end{array}$$

118.125=*L.* 118 2 6 Anfwer.

Or, by practice, thus:

87	10	0	for *L*: 100 ann.
21	17	6	for 25
8	15	0	for 10
L. 118	2	6	as before.

2. What

2. What must I receive for L. 29, 3 *per cent.* annuities, when the price is 74 *per cent.*?

74
29
666
148
21.46 = L. 21 9 $2\frac{1}{2}$.

Or by practice, thus:

74			
14	16	0	for 20
2	19	$2\frac{2}{5}$	for 4
3	14	0	
21	9	$2\frac{2}{5}$	as before.

3. What is the value of 97*l.* 16*s.* bank stock, at 120 *per cent.*?

97.5
120
117,000 Answer.

In this way are all computations in the stocks, and single blanks and prizes, made; which is so easy and expeditious, that more examples would be quite unnecessary.

Variety IX. FACTORAGE.

FACTORS are merchants agents, residing abroad, constituted by letters of attorney to act for their constituents.

Supercargoes are employed by merchants to go voyages, and dispose of cargoes to the best advantage. Storekeepers frequently get the name of supercargoes, who have the chief management of stores abroad, in vending goods, and making remittances.

The

The premium, or allowance made to a factor for his trouble in purchasing goods, or putting off consignments, &c. is different in different countries, and for different considerations, but always rated, excepting in the case of an annual salary, at so much *per cent.*

In computing the allowance, or commission due to factors, multiply the sum upon which the commission is to be charged by the rate *per cent.* and divide the product by 100, and the quotient gives the answer.

Exam. 1. Bought goods for account of A. B. which, with charges of package, porterage, lighterage, &c. *per* invoice amount to *L.* 5756, 11*s.* 6*d.*; what commission is to be added at $2\frac{1}{2}$ *per cent.*?

$$
\begin{array}{r}
5756.575 \\
2\frac{1}{2} \\
\hline
11513.150 = 2 \text{ per cent.} \\
2878.2875 = \tfrac{1}{2} \text{ per cent.} \\
\hline
143.914375 = L\ 143\ \ 18\ \ 3\tfrac{1}{4}.
\end{array}
$$

Note 1. In dividing by 100 there is no occasion at any time to note the divisor, but simply to point off two figures, or places extraordinary for decimals.

Note 2. Questions of this nature may frequently be answered more expeditiously by practice, especially when the given rate is any given part of a pound.

The last example resumed.

$$
\begin{array}{ll}
L.\ 2\ 10\ per\ L.\ 100 = 6d. & 40)5756.575 \\
Per\ L. = 40, & \overline{143.91475 \text{ as before.}}
\end{array}
$$

Exam. 2. Negociated bills for A. B. to the amount of 4785*l.* 19*s.* what commission ought I to charge at $\frac{1}{2}$ *per cent.*?

Here

Here $\frac{1}{2}=\frac{1}{5}$ of $2\frac{1}{2}$.

Therefore, 4|0)478|5.95.

5) 119.64875 at $2\frac{1}{2}$ *per cent.*

: 3.97975 = L. 23 18 7 at $\frac{1}{2}$ *per cent.*

Or, 200)4785.95

23.97975.

Exam. 3. A. B.'s sales *per* the Diamond, amount to *L.* 4849, 11*s.* 6*d.* what is the commission at 3 *per cent.*?

$2\frac{1}{2}+\frac{1}{2}=3$. Therefore, 4|0)484|9.575

5)121.239375 at $2\frac{1}{2}$
24.2478 at $\frac{1}{2}$

145.487175 at 3 *per cent*

Or, 50) 4849.575

2) 96.9915
48.4957

145.4872

Exam. 4. My factor at Jamaica charges me 5 *per cent.* commission on my account of sales, amounting gross to *L.* 5784, 18*s.*; what will his commission amount to?

2|0). 578|4.9

289.245 = L. 289 4 10$\frac{3}{4}$

Exam.

Exam. 5. What commission is due on a bill of sales, amounting to *L.* 7418, 14*s.* at 4 *per cent.*?

4 *per cent.* is $\frac{1}{20}-\frac{1}{5}$.

Therefore, 2|0 741|8.7

370.935 at 5 *per cent.*
74.187 at 1 *per cent.*

296.748 at 4 *per cent.* = *L.* 296 14 $11\frac{1}{2}$.

Or, 50) 741.87

148.374
148.374

296,748

Exam. 6. Drawn on my correspondents at London for *L.* 5745; what premium should I have at $1\frac{3}{8}$ *per cent.*?

1 *per cent.* = $\frac{1}{100}$) 5745

$\frac{2}{8}=\frac{1}{4}$ 4) 57.45 at 1 *per cent.*
$\frac{1}{8}=\frac{1}{2}$ of that 2) 14.3625 at $\frac{2}{8}$
7.18125 at $\frac{1}{8}$

78.99375

Or, 100) 5745

2) 57.45
4) 28.725

86.175
7.181

78.994

7. Bought the following goods for A. B. *viz.*

5 Bales Oſhaburgs—60 pieces—6020 yards, at $6\frac{2}{3}$*d.*
19 pieces broad cloth—475 yards, at 13*s.* $8\frac{7}{8}$*d.*
2 cheſts vermillion—4834 *lbs.* at 15*s.* $7\frac{3}{4}$*d.* *per lb.*
5478 *oz.* ſilver, at 4*s.* $10\frac{5}{8}$. *per oz.*
80 pieces fine lawns—800 yards, at 3*s.* $7\frac{7}{8}$*d.* *per* yard.
30 dozen, 7 pair ſtockings, at 33*s.* $4\frac{1}{2}$*d.*
13 *cwt.* 3 *qrs.* 19 *lbs.* refined ſugar, at $8\frac{1}{2}$*d.* *per lb.*
Package and other charges, *L.* 15, 7*s.* 8*d.*
Required a complete invoice. adding commiſſion at $3\frac{1}{2}$ *per cent.*?
Anſwer, 6387 : 9 : 11.

8. Negociated bills for A. B. to the amount of *L.* 397845, 18.; what is my commiſſion at $\frac{1}{4}$ *per cent.*?

Anſwer, *L.* 994 : 12 : $4\frac{3}{4}$.

OBSERVATIONS.

When a factor hath bought or ſold purſuant to orders, he ought immediately to adviſe his principal, leſt his former orders ſhould be contradicted. Frequency and punctuality in writing, a proper knowledge of the value, fall, and riſe of goods, both at home and abroad, diligence in executing orders, and honeſty and punctuality in giving a faithful account, are the true and infallible means of raiſing and ſecuring the reputation of a factor,

2. When a merchant ſends out an invoice to his factor, he generally charges it with 5, 10, or 12 *per cent.* according to circumſtances, in one caſe that the factor may not be acquainted with all the profits; but, particularly, with regard to a ſupercargo, that he may ſell at ſo much profit upon the invoice.

3. There are no particular laws or regulations, that I have ſeen, in regard to the price of commiſſion. In Jamaica and in moſt parts of America, it runs about 10 *per cent.* for ſales and remittances; in Holland, Italy, &c. and other places nearer home, at $2\frac{1}{2}$; in ſome places on the continent, 2 *per cent.*

Variety X. INSURANCE.

INSURANCE is a ſecurity, or aſſurance, by means of a writ called a *policy*, to indemnify the inſured of ſuch loſſes as ſhall be ſpecified in the policy ſubſcribed by the inſurer, or inſurers, and entered in ſome particular office, as a teſtimony or voucher of the tranſaction, by which the underwriters oblige themſelves to make good and effectual the property inſured, in conſideration of a certain premium at a ſtipulated rate *per cent.* which varies according to the riſk, to be immediately

immediately paid down, or otherwise secured, according to the tenor of the agreement. In case of loss, the underwriters can retain a certain discount, generally 2 *per cent.* and only pay what is called the *short recovery*.

Case 1. When the premium at a certain rate *per cent.* for insuring a given sum is required, the operation is the same as in factorage.

Exam. 1. Insured at Hamilton's office, the value of *L*.574, at $7\frac{1}{2}$ *per cent.*; what is the premium?

```
2[0) 57|4
     ————
  2) 28.7   for 5 per cent.
     14.35  for 2½
     —————
     43.05  for 7½ = L.43, 1s.
```

Exam. 2. Insured with Dunlop, Glen and Peters, the value of *L*.3786, at $14\frac{1}{2}$ *per cent.*; what is the premium?

```
 10) 3768
     ————
  5) 376.8  for 10 per cent.
      75.36 for  2
  4)  75.36 for  2
      18.84 for  ½
     ——————
     546.36 for 14½ per cent. = L.546 7 2⅖.
```

Case 2. To find the sum necessary to be insured, when the adventurer would cover, or make good his outset in case of loss; that is, to recover from the underwriters the whole value at risk; to the rate *per cent.* premium add the ordinary discount, and subtract that sum from *L*.100 for the first term, let *L*.100 be the second, and the value at risk the third, then will the fourth proportional be the answer.

Exam. 1. It is required to cover *L*.500, premium 8 *per cent.* and 2 *per cent.* discount in case of loss?

L.

$100-8+2=90 : 100 :: 500$
100

9|0) 5000|0

L.555 11 $1\frac{1}{2}$.

Note, It is plain, that when we want to cover *L*.90, we must in this case insure *L*.100; therefore, to cover *L*.500, we must insure *L*.555 : 11 : $1\frac{1}{3}$; for when 10 *per cent*. for discount and premium is deducted, we shall have *L*.500 remaining nett.

For 555	11	$1\frac{1}{3}$	insured at 8 *per cent*.
44	8	$10\frac{2}{3}$	premium to be deducted.
511	2	$2\frac{2}{3}$	remains.
11	2	$2\frac{2}{3}$	2 *per cent*. disc. to be deducted.
500	0	0	first outset.

Exam. 2. It is required to cover *L*.575, premium $14\frac{1}{2}$ *per cent*. 2 *per cent*. discount in case of loss?

100
$14\frac{1}{2}+2=16.5$

$83.5 : 100 :: 575$
100

83.5|57500.

688.623, &c.

Variety XI. COMPUTATIONS in EXCHANGE.

INTRODUCTION.

EXCHANGE is the commutation of the money of one country for that of another, by means of a bill, instrument, or writ, commonly called *a bill of exchange*;

Exchange may likewise be defined, a fixing of the actual aud momentary value of money. Silver, as a metal, hath a value like all other merchandises; but as it is capable of becoming the sign of all other merchandises, or the medium by which they can be estimated, it may receive an additional value: for were it no more than a mere merchandise, its value would perhaps be less fluctuating, and of less consideration than it is.—As money, the prince can fix a value upon silver in some cases, and in others he cannot.—He can fix a proportion betwixt silver as a metal, and silver as money; betwixt the several metals made use of to pass as money; he establishes the weight and standard of every piece of money, and assigns to it that ideal value by which it is current. On the other hand, if we consider the money of one country comparatively with that of another, it receives a new value, which is fixed by the current course of commerce, and the general opinion of merchants; but never by the laws of any particular nation, because it is liable to incessant variations, and depends on the accidental circumstances of trade, the money transactions between nations, and the state of their public credit. The several nations, in fixing this relative value, are chiefly guided by that particular nation which hath the greatest quantity of specie. If any one nation hath as much specie as several others together, it will then become necessary for these several nations to be regulated by the standard of that one nation. In the actual state of the universe, Holland, in this respect, seems to be the umpire, since she regulates the exchange for almost all Europe, in a manner most agreeable to her own interest. This scarcity or plenty, from whence results the mutability of the course of exchange, is not real, but relative: for instance, when Glasgow hath greater occasion for funds in London, than London of having funds in Glasgow, the price of bills must rise at Glasgow. The specie of both cities is the same, both as to weight and standard; and although there should be money enough to purchase bills at Glasgow upon London, yet when there is not a fund of credit at London equal to the debt, the price of bills, not of money, must rise of course.

To set this subject in a more practical point of view, let us consider,

1. That if our purchases and payments in foreign countries exactly balance their purchases and payments in ours, there will be just enough of bills on the one to clear accounts with the other; so that in this case the exchange on both sides will be at par; that is, one who gives money in one country, will receive as much in the other in weight and standard.

2. If

2. If a nation supplies us with more than it takes from us, or if owe we ~~pay~~ the nation more money than it pays to us, there will be a balance against us, which we must necessarily pay; in order to which, the demand for the money of that nation, or its bills of exchange, becomes greater among us than the quantity to supply that demand, which raises the value of their money or bills, and lowers ours, or, in other words, puts the price of their money above par, and ours below it, which constitutes what we call *the course of exchange*. From these two considerations we may naturally infer,

1. That the course of exchange betwixt two nations is a herald, which proclaims publicly the state of commerce and money-negociations betwixt them, and which of the two is indebted to the other.

2. That the nation which is indebted hath the disadvantage in commerce and money-transactions, and that the one which hath the balance in its favour, hath in every respect the advantage.

3. That the balance of trade naturally imports specie, and renders money at home more valuable abroad; whereas, on the other hand, when the balance is against a nation, their specie is exported, and becomes thereby less valued.

Art. I. Exchange with America and the West Indies.

In America and the West Indies, as in other parts of the British dominions, accounts are kept in pounds, shillings, and pence, divided as in Britain, and their money, for distinction's sake is called *currency*. Upon the continent payments are seldom made in specie, as there are few coins circulating among them, but some French and Spanish pieces, the value of which, by a statute in the sixth year of Queen Anne was ascertained as follows:

	Weight.		*true value.*		*cur. val.*	
	dwt.	*gr.*	*s.*	*d.*	*s.*	*d.*
Dollar old plate of Seville	17	12	4	6	6	0
Ditto of new	14	—	3	$7\frac{1}{2}$	4	$9\frac{5}{6}$
Mexico ditto	17	12	4	6	6	0
Pillar ditto	17	12	4	$6\frac{1}{4}$	6	0
Peru ditto old plate	17	12	4	5	5	$10\frac{3}{8}$
Cross dollar	18	—	4	$4\frac{1}{2}$	4	$10\frac{5}{8}$
Ducatoon of Flanders	20	21	5	6	7	4
French old crown	17	12	4	6	6	0
Crusado of Portugal	11	4	2	$10\frac{1}{4}$	3	$9\frac{5}{6}$
Three guilder piece of Holland	20	7	5	$2\frac{1}{4}$	6	$10\frac{11}{12}$
Old rixdollar of the empire	18	10	4	$6\frac{3}{4}$	6	0

The scarcity of specie obliges them to substitute a paper currency for carrying on their trade, which being subject to innume-

rable casuelties, suffers generally a very great discount for Sterling in the purchase of bills of exchange, or good silver or gold. This is not the case, however, with the West Indies; for their intercourse with the Spanish settlements furnishes them with such an abundance of specie, that at an average the exchange may be reckoned at 7 currency to 5 Sterling.

Examples of the Exchanges with America.

Exam. 1. Glasgow receives an account of sales from Philadelphia, the nett proceeds amounting to *L.*575:19:6 currency; for how much sterling may Glasgow debit Philadelphia, the exchange being at 80 *per cent.*?

	180 : 100				
Cancel the ciphers and divide by 2	9 : 5 ::	575	19	6	
				5	
	9)	2879	17	6	
		319	19	$8\frac{2}{3}$	Answer.

Exam. 2. Glasgow receives a bill of exchange from Philadelphia for *L.*319:19:$8\frac{2}{3}$; for how much currency is Glasgow debited at Philadelphia, the exchange being at 80 *per cent.*?

	180 : 100				
By cancelling and dividing as above	5 : 5 ::	319	19	$8\frac{2}{3}$	
				9	
	5)	2879	17	6	
		575	19	6	currency Ans.

Exam. 3. Virginia is indebted to Glasgow in *L.*575:19:6 Sterling; with how much currency will Glasgow be credited at Virginia, when the exchange is at $33\frac{1}{3}$ *per cent.*?

First 100 : $133\frac{1}{3}$
3 3

300 : 400 both terms reduced to thirds.

By

By cancelling the ciphers, it will be 3 : 4 : : 575 19 6
4

3) 2303 18 0

767 19 4 cur.

Or practically

575 19 6 for L.100
191 19 10 for $33\frac{1}{3}$

L. 767 19 4 Answer.

Or thus, L.575 19 6 for 100
191 19 10 for $33\frac{1}{3}$ or $\frac{100}{3}$
$133\frac{1}{3}$

767 19 4 currency. Answer.

OBSERVATION.

When Britain exchanges upon the L.100, as in the above instances, the higher the exchange is, the advantage to Britain in remitting is the greater, and in drawing the less. Suppose, for instance, that the exchange betwixt Britain and Ireland is at 12 *per cent.* I can in that case purchase a bill for L.100 Sterling to discharge a debt of L.112 Irish; whereas had the exchange been at 5 *per cent.* the same bill would have cost me L106 : 13 : 4 Sterling; but what I gain by remitting on this occasion is lost by the drawer of the bill; for his credit in Ireland is lessened by L.112 Irish, and he hath only received L.100 Sterling, whereas had the exchange been at 5 *per cent.* he would have received L.106 : 13 : 4 Sterling, for his 112 Irish. They who deal in exchange with Ireland, ought to be well informed at all times of the state of trade betwixt the two nations, and on whose side the balance lies; for as the rise and fall of exchange is the true barometer of the balance of trade, so likewise, by having a proper intelligence of the imports from Ireland, and exports thither, one may in a great measure discern what will be the state of the exchange. Suppose, for example, Ireland had imported from Britain goods to the amount of L.20,000, and had exported thither to the value of but L.10,000, it is plain that Ireland can be at par with Britain for no more than L.10,000; and yet there is a balance of L.10,000 still due, which must be remitted to Britain before the account is evened. When there is no money due in Britain to compensate this balance, Sterling money in Ireland will become dear, and Irish money cheap, and as the demand for bills increases, the price will be proportionally raised. The Irish merchant who foresees this, will lay in a fund of credit in Britain for the occasion; and though at this time he can receive L.112 Irish for his draught of L.100, he may be able, by the time his bill falls due, to purchase remittances at L.105. The British merchant, on the other hand, will muster up all he can to purchase remittances, to raise a stock of Irish money, which, upon the turn of the balance he

can draw for, with the odds of 5 or 6 *per cent.* perhaps in his favour.

When the exchange with the plantations in America is high, which is generally the case where there is not a sufficiency of produce fit for the British market to answer the imports from Britain, bills of exchange are often a very expensive remittance: for which reason those who have stores abroad, and can afford to lie a little out of their money, chuse rather to purchase such produce as will come to the quickest market in some other colony upon the continent, or in the West Indies, in order to be remitted from thence in produce or in bills of exchange.

Examples of Exchange applied to drawing and remitting.

Exam. 1. When the exchange with Ireland rose to 12 *per cent.* Ireland drew on London for *L.*5000 Sterling; how much Irish must be remitted to London to discharge the debt when the exchange falls to 6 *per cent.*?

First, 5000 at 100 *per cent.*
500 at 10 *per cent.*
100 at 2 *per cent.*

5600 at 112 Irish received for draughts.

2dly, 5000 at 100 *per cent.*
250 at 5 *per cent.*
50 at 1 *per cent.*

5300 at 106 Irish remitted.

Difference 300 gained by Ireland, which is 6 *per cent.*

Exam. 2. When the exchange was at 7 *per cent.* a merchant in London drew on Dublin *per L.*2749 Sterling, when he came to replace his draughts, bills were sold at $9\frac{3}{4}$; how much Sterling did the remittance cost?

Irish.	*Ster.*	*Irish.*	*L.*	*s.*	*d.*
$108\frac{1}{3}$:	2749 ::	$109\frac{3}{4}$:	2713	10	$3\frac{3}{4}$

By this negociation London saves *L.*35 : 9 : $8\frac{1}{4}$ in remitting, and $1\frac{5}{?}$ Irish in the sale of his bills.

Art. III. Exchange with Holland.

Britain exchanges with Holland upon the pound Sterling, for which the latter gives an uncertain number of ſhillings and pence or grotes Flemiſh, according to the courſe of exehange, which runs from 30 to 40*s.* Flemiſh *per* 20*s.* Sterling. The par of a pound Sterling, according to Sir Iſaac Newton's table, will be found to be L.1:16:6 Flemiſh; but a guinea paſſes in Holland for 12 guilders, according to which eſtimation their coins may be reckoned as follow:

A duke - -	L.	0	0	$0\frac{21}{106}$
A ſtiver - -		0	0	$0\frac{1}{20}$
A ſchilling - -		0	0	$6\frac{3}{10}$
A guilder - -		0	1	9
A Zealand dollar -		0	2	$7\frac{1}{2}$
A rixdollar - -		0	4	$4\frac{1}{2}$
A dry guilder - -		0	5	3
A ducat - -		0	9	$2\frac{1}{2}$

To compute the exchanges with Holland, or any other place where it is made upon the pound Sterling.

Caſe 1. If Dutch money is required, let 1*l.* Sterling be the firſt term, its equivalent Dutch the ſecond, and the Sterling to be exchanged the third; then will the Dutch money required be the fourth proportional. The equivalent Dutch money will likewiſe be found very readily by practice.

Caſe 2. If ſterling is required, let the Dutch money equivalent to 1*l.* Sterling be the firſt term, 1*l.* the ſecond, and the given Dutch the third, then will the Sterling required be the fourth proportional.

Examples of exchanges with Holland.

Exam. 1. London is indebted to Holland in L.270:8:2 Sterling, with how much Flemiſh is London debited at Amſterdam, when the exchange is at 35*s.* 6*d.* Flemiſh *per* pound Sterling?

L. St.

L.S.		L. Fl.		
1	:	1.775	: :	270.40833
				1.775
				135204166
				189285833
				1892858333
				27040833333
				479.97479166 *L.* = 479 19 $5\frac{11}{20}$ Flemish.

By Practice thus:

				L. Flem.		
270	8	2	for	1	0	0
135	4	1	for	0	10	0
67	12	$0\frac{1}{2}$	for	0	5	0
6	15	$2\frac{1}{20}$	for	0	0	6
479	19	$5\frac{11}{20}$	as before			

Holland exchanges with the trading nations upon the continent as follows:

With France upon the French crown, for 54 grotes
With Hamburg, upon the dollar, for 32 Flemish schillings,
With Spain, upon the ducat of 375 marvedies, for 97 grotes,
With Portugal, upon the crusado of 400 reas, for 44 grotes,
With Genoa, upon the piastre of 5 liv. banco, for 92 grotes,
With Venice, upon the ducat of 24 gros banco, for 88 grotes,
With Leghorn, upon the piastre of 20 sols d'or, for 86 grotes,
With Genoa, upon the crown of 60 sols curt. for 90 grotes,

} more or less, according to the course.

And the computation is the same with the exchanges betwixt Britain and the same places.

Art. IV. Exchange with the Auſtrian Netherlands.

Antwerp was once the metropolis for trade of the whole Seventeen Provinces, although Amſterdam and Rotterdam are at this day by far its ſuperiors. It is however the principal place of exchange in the Auſtrian Netherlands, and ſtill hath a conſiderable trade. The par of a pound Sterling at Antwerp, according to Sir Iſaac Newton, is 34*s.* 11*d.* Flemiſh; but later authors make it different; ſome 35*s.* $6\frac{1}{2}$ *fl.* others 35*s.* 2*d.* and others $38\frac{2}{7}$*s.*; but the courſe is allowed by all to run from 30 to 40 ſchillings Flemiſh *per* pound Sterling.

Examples of exchanges with Antwerp.

Exam. 1. How much Flemiſh will anſwer a London draught of *L.*374 : 19 Sterling, exchange at 37*s.* 6*d. per* pound Sterling?

374	19	0	for	20	
187	9	6	for	10	
93	14	9	for	5	
46	17	$4\frac{1}{2}$	for	2	6
				37	6
*L.*703	0	$7\frac{1}{2}$	Flemiſh. Anſwer.		

Exam. 2. How much Sterling will anſwer an Antwerp bill of *L.*703:0:$7\frac{1}{2}$ Flemiſh, exchange at 37*s.* 6*d.* Flemiſh *per* pound Sterling?

37 6   703 0 $7\frac{1}{2}$
2   40

75 ſixpences : 1 :: 5)28121.25 ſixpences.

5)5624.25

3)112.485

374.95=*L.*374:19 Sterl.

Art.

Art. V. Exchange with Hamburg.

They keep their accounts in the bank and through the city, either in rixdollars, sols, and deniers lubs, or in marks, sols, and deniers lubs. The rixdollar is worth 3 marks, or 48 sols lubs, weighing 532 grains.

The livre gros, or pound Flemish is equal to $7\frac{1}{2}$ marks lubs, or 20 sols gros, or 120 sols lubs.

The mark lubs is divided sometimes into 32 gros, but more generally into 16 schillings lubs, and each of these into 12 phennings.

Hamburg exchanges with Britain in schillings and grotes Flemish, and the par of their rixdollar is reckoned at 4*s.* 6*d.* Sterling, so that the par of *L.* 1 Sterling is 13 marks 5 schillings lubs, 35*s.* $6\frac{2}{3}$*d.* Flemish.

The value of the rixdollar being every where known, and its standard invariable, it is applied to the valuation of all kinds of merchandises as well as coins. The principal current coins in those parts are those of Denmark and Holstein, Lubec and Hamburg, which, taking them at the par may be valued as follow:

A tryling $\frac{1}{4}$ of a phenning - -	*L.* 0	0	$0\frac{3}{128}$	Sterling.
A sixling $\frac{1}{2}$ of a phenning -	0	0	$0\frac{3}{64}$	
A phenning of $\frac{1}{12}$ of a schilling lubs	0	0	$0\frac{3}{32}$	
One schilling lubs $\frac{1}{16}$ of a mark	0	0	$0\frac{1}{8}$	
The dollar=2 marks - - -	0	3	0	
The rixdollar=3 marks - - -	0	4	6	
The ducat of $6\frac{1}{4}$ marks - - -	0	9	$4\frac{1}{2}$	

The current money hath been so much adulterated of late years, that the agio hath risen from 15 to 20, to 30 and 40 *per cent.*; but all bills of exchange are paid in bank.

Examples of exchange with Hamburg.

Exam. 1 London draws on Hamburg for *L.*500 Sterling; how many marks must be paid at Hamburg, the exchange at 33*s.* 6*d.* Flem. banco *per* pound Sterling?

As 20 Flem. $=\frac{1}{2}$ marks, it will be 20 : 7.5 : : 35.5

The two first terms abridged by 5, 4 : 1.5 : : 35.5

$$\begin{array}{r} 1.5 \\ \hline 4)\ 53.25 \\ \hline 13.3125 \text{ marks.} \\ =L.\ 1 \text{ Sterl.} \end{array}$$

Hence

Hence 1.5 will be a conſtant multiplier, and 4 a conſtant diviſor, for finding the marks contained in the courſe of exchange, equal to a pound Sterling.

Hamburg exchanges with other trading nations as follows

With France, upon the crown of 60 ſols, for 27 ſchil. lubs,	more or leſs, according to the courſe.
With Spain, upon the ducat of 375 mervadies, for 93 gros,	
With Portugal, upon the cruſade of 400 reas, for 42 gros,	
With Venice, upon the banc ducat of 24 gros, for 86 gros,	
With Vienna, upon 100 Hamburg rixdollars banco, for 139 rixdollars of the empire,	
With Nuremberg, on ditto, for 135 dollars of Nuremberg,	

Art. VI. Exchange with France.

Paris and Bourdeaux are the principal places of exchange in France; and indeed, in theſe places, the buſineſs of exchange is particularly ſtudied. Accounts are kept throughout the French dominions, in livres, ſols, and deniers, divided as the British pound. In exchanging with France we pay ſo many pence Sterling for their crown or ecu of 3 livres, or 60 ſols Tournois. As they have not always any piece of coin of that value, this ideal crown, or crown of exchange, is diſtinguiſhed from the real crown, or ecu'd'argent, by the name of the *crown of 60 ſols Tournois*.

	L.	s.	d.
A denier	0	0	$0\frac{13}{320}$
A liard of 3 deniers	0	0	$0\frac{39}{320}$
A dardane of 2 liards	0	0	$0\frac{39}{160}$
A ſol of 2 dardanes	0	0	$0\frac{39}{80}$
A frank of 20 ſols or 1 livre	0	0	$9\frac{1}{4}$
A crown of exchange 60 ſols	0	2	$5\frac{1}{4}$
A double crown of 6 livres	0	4	$10\frac{1}{2}$
A lewis d'or of 8 crowns	0	19	6

Exam. 2 London received at Paris 13161 livres 5 ſols and $9\frac{2}{3}$ deniers; for how much Sterling was the draught, the exchange being at 31*d*. Sterling *per* ecu?

L.3 : 31 :: 13161.263
31
39483789
3)407999.153
12) 135999.717
20) 11333 $3\frac{3}{4}$
566 13 $3\frac{3}{4}$

Or thus,

3) 13161 5 $9\frac{2}{3}$
8) 4387 1 11
30) 548 7 9 at 30*d.*
18 5 7 at 1
L.566 13 4 Anſwer.

Art.

Art. VII. Exchange with Spain.

The monies of Spain are of two ſorts, the one called *plate money*, and the other *vellon*. A rial vellon is worth in Spain $8\frac{1}{2}$ quarts copper money, and the rial of old plate of exchange is worth 16 vellon, and the effective rial of new plate 17; which makes a difference between theſe two ſpecies of rials at 32 to 17, or $53\frac{1}{3}$ *per cent*.

By the word *plate* is underſtood ſilver money, wherein ſome of the merchants keep their accounts; and that which is uſed for the negociation of foreign exchanges is diſtinguiſhed by the name of *old plate*, which is ideal in the ſame ſenſe with the exchange-crown of France, or the pound Sterling of Britain

The foreign bankers or remitters at Madrid, Cadiz, Seville, &c. keep their accounts in piaſtres, rials, and mervadies old plate, reckoning 34 mervadies to a rial, and 8 rials to a piaſtre, the par of which is 3*s.* 7*d.* Sterling.

The ſhopkeepers of Madrid, the cuſtom-houſe and other dealers within the kingdom keep their accounts in rials and mervadies vellon. Some merchants particularly in Valencia, keep their accounts in piaſtres, ſols, and deniers, divided as the French livre or Britiſh pound.

The doubloon of exchange is equal to 4 piaſtres, or 32 rials.

The ducat or ducado current, is equal to 11 rials old plate of 374 mervadies; but the ducat of exchange is equal to 375 mervadies.

The piaſtre of exchange is likewiſe reckoned at 15 rials vellon, and 2 mervadies——It is proper that the drawer of a bill upon Spain ſhould expreſsly ſtipulate the payment to be made either in gold or ſilver, or the bearer of the bill may ſuſtain a loſs of $1\frac{1}{2}$ *per cent*.

The Spaniſh ſilver and copper coins, from the above par, may be eſtimated as follows:

A mervadie - - - -	L. 0	0	0 43/[illegible]
A quartile=2 mervadies - -	0	0	0 [illegible]
A rial plate=17 quartiles, or 34 mervadies -	0	0	$5\frac{3}{4}$
A piſtrine=2 rials plate - - -	0	0	$10\frac{3}{5}$
A dollar, old plate of Seville=10 rials - -	0	4	6
A dollar of new plate=8 rials plate - -	0	3	7
Mexico ditto - - - -	0	4	6
Pillar ditto - - -	0	4	$6\frac{3}{4}$
Peru ditto old plate - - -	0	4	5
A croſs dollar - - -	0	4	$4\frac{2}{4}$

The gold coins are piſtoles and their fractions; the piſtole is worth 4 dollars, or 17*s.* 11*d.* and the fractions in proportion.

The courſe between Britain and Spain is always below par, from 35 to 40 pence *per* piaſtre.

Examples

Examples of Exchanges with Spain.

Exam. 1. London remits to Cadiz $L.576:12:2\frac{3}{4}$ Sterling, exchange at $37\frac{1}{8}d.$ *per* piastre; how much will be received for this remittance at Cadiz?

$$
\begin{array}{l}
\begin{array}{cccccc}
d. & & piast. & & L. & \\
37\frac{1}{8} & : & 1 & :: & 576 & 12 \quad 2\frac{3}{4} \\
\underline{\quad 8 \quad} & & & & \underline{\quad 20} & \\
303 & & & & 11532 & \\
 & & & & \underline{\quad 12} & \\
 & & & & 138386 & \\
 & & & & \underline{\quad 8} & \\
 & & & & 1107094 &
\end{array}
\end{array}
$$

$$
\begin{array}{r}
303)\,1107094\,(3653{\cdot}775 = \overset{piast.}{3653}\quad \overset{rl.}{6}\quad \overset{mer.}{7}\ \text{Ans.} \\
\underline{909}\qquad\qquad\qquad\qquad\qquad\qquad\qquad \\
1980\qquad\qquad\qquad\qquad\qquad\qquad\quad \\
\underline{1818}\qquad\qquad\qquad\qquad\qquad\qquad\quad \\
1629\qquad\qquad\qquad\qquad\qquad\qquad \\
\underline{1515}\qquad\qquad\qquad\qquad\qquad\qquad \\
1144\qquad\qquad\qquad\qquad\qquad \\
\underline{909}\qquad\qquad\qquad\qquad\qquad \\
2350\qquad\qquad\qquad\qquad \\
\underline{2121}\qquad\qquad\qquad\qquad \\
2290\qquad\qquad\qquad \\
\underline{2121}\qquad\qquad\qquad \\
1690\qquad\qquad \\
\underline{1515}\qquad\qquad \\
175\qquad\qquad
\end{array}
$$

Art. VIII. Exchange with Portugal.

In Lisbon, and, in general, throughout the Portuguese dominions, accounts are kept in milreas and reas, reckoning 1000 of the latter to one of the former. The milrea is no real coin, but an imaginary piece of account, of which a crusado of silver contains $\frac{48}{1000}$, or 0ω480=480 reas. The par of a milrea is 5*s.* 7½*d.* according to which the gold monies of Portugal are as follows:

The piece of 25ω600 double Joannes -	L. 7	4	0
Ditto of 24 - - - -	6	15	0
Ditto of 12ω800 single Joannes - -	3	12	0
Ditto of 12 - - - - - -	3	7	0
Ditto of 6ω400 half Joannes - -	1	10	0
Ditto of 4ω800 moidore stamped - -	1	7	0
Ditto of 3ω200 quarter Joannes - -	0	18	0
Ditto of 2ω400 half moidore - -	0	13	6
Ditto of 1ω600 ⅛ Joannes - - -	0	9	0
Ditto of 1ω200 quarter moidore - -	0	6	9
Ditto of 0ω800 $\frac{1}{16}$ Joannes, or testoon piece -	0	4	6

The silver monies as follows:

The causado of 400 reas not stamped - -	L. 0	2	3
Ditto of 480 reas stamped in 1643 -	0	2	8⅖
The 12 vintin piece of 240 reas - -	0	1	0
The 5 ditto of 100 reas - - -	0	0	9
The 2½ vintin of 50 reas - -	0	0	4½

The copper coin as follows:

The vintin piece of 20 reas - - -	0	0	1½

The half and quarter ditto, according to the same proportion.

The course of exchange betwixt Britain and Lisbon is betwixt ...s. and 5*s.* 8*d.*

EXAMPLE.

Exam. 1. London remits to Oporto L. 578 : 19 : 6, exchange 5*s.* 3*d.* *per* milrea; what will be received at Oporto?

s.	*d.*		*m.*		*L.*	*s.*	*d.*	
5	3	:	1	: :	578	19	6	
4					20			
21 *threepen.*					11579			
					4			
					3) 46318			
					7) 15439 ω 333			
					2205 ω 619			Answer.

Art. IX. Exchange with Genoa.

Accounts are kept in the bank, in piastres or pezzoes, which are divided into soldi and denari, as the British pound; but some of the merchants keep their accounts in lires or liras, soldi and denari, divided as before: this money is only $\frac{1}{5}$ of the value of the other, as the Scots money is $\frac{1}{12}$ of Sterling.

The par of { a pezzoe or piastre $54d.$
a lire or lira - $10\frac{4}{5}.$

According to which their coins may be estimated as follows:

A denari - - - -	*L.* 0	0	$0\frac{9}{240}$
A soldi or 12 denari - -	0	0	$0\frac{9}{20}$
A chevalet or 4 soldi - -	0	0	$1\frac{1}{2}$
A testoon or 30 soldi - -	0	1	$1\frac{1}{2}$
A genioni or 6 testoons - -	0	6	9
A pistole - - -	0	15	0
A Spanish pistole - - -	0	17	11

The exchange runs between 45 and 50*d.*

Examples of exchange.

Exam. 1. In 784 *pez.* 19*s.* 6*d.* lire money, how much money of exchange?

	p.	*s.*	*d.*
5)	784	19	6
	156	19	$10\frac{4}{5}$ exchange money. Answer.

Exam.

Exam. 2. Edinburgh remits to Genoa $L.732:18:1\frac{3}{4}$ in payment for a debt of 3390 pezzoes 16 solz; what was the rate of exchange? Answer, $51\frac{7}{8}d.$

Exam. 3. Genoa consigns to London 1470 yards of velvet, which brought L.1399 : 10, clear of all deductions, for which London is ordered to send 500 yards gauzes at 5*s.* 3*d.* *per* yard, and to remit the balance in bills; the exchange at this time was at 50*d.*; how many piastres, &c. were remitted?

	p.	*s.*
Answer,	6087	12.

Art. X. Exchange with Leghorn.

In Leghorn accounts are kept in piastres, soldi, and denari, divided as at Genoa. Some likewise keep their accounts in liras or lires, divided as the piastre; but this money is only $\frac{1}{6}$ of the money of exchange.

The par with London is 4*s.* 4*d.*, but the course runs from 45 to 50*d.* only.

The coins of Leghorn may be estimated as follows:

			L.		
A denari			0	0	$0\frac{13}{360}$
A quatrini,	4	denari	0	0	$0\frac{13}{90}$
A soldi,	3	quatrini	0	0	$0\frac{13}{30}$
A caraca or grain,	5	quatrini	0	0	$0\frac{13}{18}$
A julio or paulo,	8	grains	0	0	$5\frac{7}{9}$
A piastre of exchange			0	4	4
A ducat of 150 soldi			0	5	5
A pistole of 21 lires			0	15	6

Examples of exchange.

Exam. 1. London draws on Leghorn for *L.*465 : 19 : 6 Sterling; what must be paid at Leghorn, the exchange at 46*d.* *per* piastre?

46 : 1 :: 465 19 6

20

9319

6

23) 55917

Piastres 2431 3 $5\frac{3}{4}$ Ans.

By estimating the fractions sometimes above their value, and at other times below the value, as seems most convenient, perplexing denominators are avoided, and the answer found with sufficient exactitude.

Art. XI. Exchange with Venice.

The accounts of the bank are kept in livres, sols, and deniers gros: the livre is equal to 10 ducats bank, or 240 gros, the ducat being equal to 24 gros.

Money of exchange is always understood to be that of ducats in bank, which is imaginary, 100 whereof make 120 ducats current money; so that the difference betwixt bank and current money is an agio of 20 *per cent.* though the brokers have invented another agio to be added, which is more or less according to bargain.

The par of a ducat banco is 4*s.* 4*d.* Sterling, and the course between 45 and 50*d.*

The Venetian coins are as follows:

A picoli	*L.*	0	0	$0\frac{5}{181}$
A soldi, or 12 picoli		0	0	$0\frac{60}{181}$
A Jule, or 18 soldi		0	0	$5\frac{75}{181}$
A testoon, or 3 Jules		0	1	$5\frac{163}{181}$
A ducat current, or 124 soldi		0	3	4
A chequin, or 17 lires		0	9	2

Lire money is divided as the British pound, and 1 ducat banco is worth $7\frac{4}{5}$ lires.

Examples of exchange.

Exam. 1. Venice draws on London for 2850 *duc.* 10 *sol.* $10\frac{14}{73}$ *den.* banco, at $45\frac{5}{8}$*d.* *per* ducat; how much Sterling will pay the draught?

$$
\begin{array}{llll}
6) & 2850 & 10 & 10\frac{14}{73} \\
\hline
8) & 475 & 1 & 6\frac{2}{3} \text{ at } 40d. \\
8) & 59 & 7 & 9 \text{ at } 5d. \\
 & 7 & 8 & 5\frac{1}{3} \text{ at } \frac{5}{8} \\
L. & 541 & 18 & 0 \text{ at } 45\frac{5}{8}. \text{ Answer.}
\end{array}
$$

Exam. 2. London draws on Venice for *L.* 541 : 18*s.* Sterling; how much must be paid at Venice, exchange at $45\frac{5}{8}$*d.* *per* ducat banco?

```
            541  18
             20
          ---------
          10838
             12
          ---------        duc.    s.  d.
45625) 130056.000(23850   10  10 14/73. Answer.
        91250
        ------
        388060
        365000
        ------
         230600
         228125
         ------
          24750
             20
          ------
          495000
          45625
          ------
           38750
              12
          -------
          465000
          45625
          ------
            8750
```

The foregoing are the remarkable places of exchange in Europe with which Britain and Ireland hath occafion to negociate, as all the other places with which we may have commerce, receive and make payments by the medium of Amfterdam, Hamburg, or Venice; and if the examples of converting the money of one country into that of another have been properly attended to, it may reafonably be prefumed, when the courfe of exchange is known, that there will be very little difficulty in reducing Sterling to its equivalent value in the money of account in any other country, and the contrary. It will not, however, be improper to add what follows.

I. In Denmark and Norway

Accounts are kept in marks and ſchillings, reckoning 16 Daniſh ſchillings to a mark; their real monies being proportioned as under.

A rixdollar	=	6 Daniſh marks.
A Daniſh crown	=	4 ditto
A double ditto	=	8 ditto.
A rix ort	=	24 Daniſh ſchillings.
An ebrew	=	28 ditto.
A rixmark	=	20 ditto.
A common ditto	=	16 ditto.
A Daniſh gludſtadt	=	6 ditto.
A foreign ditto	=	5 ditto.

The courſe of exchange with London is betwix 45 and 58 pence *per* rixdollar; with from 12 to 18 *per cent.* in favour of Hamburg to receive rixdollars for Daniſh crowns; in favour of Amſterdam from 8 to 12, and in France from 75 to 85 rixdollars *per* 100 crowns.

EXAMPLES.

1. Denmark is indebted to Britain in 7456 merks, 14 ſchillings; for how much Sterling may Britain draw, exchange at 50*d.* *per* rixdollar?

Anſwer, *L.* 258 : 19 : 4$\frac{3}{4}$.

2. A cargo of timber was ſold at Leith for *L*375 : 19 : 7; what will this money reckon at Bergen, exchange at 49$\frac{3}{4}$ *per* rixdollar?

Anſwer, 1813 rixdollars, 4 marks, 10$\frac{3}{4}$ ſchillings.

II. In POLAND.

Some keep their accounts in pence, groſſes, and florins, reckoning 18 pence to 1 groſs, and 30 groſs to a florin; and others in rixdollars and groſſes, reckoning 90 groſs to a rixdollar.

Their real money is proportioned as under:

				s.	*d.*	
18 groſſes or groſhen	=	1 ort	=	0	10$\frac{4}{5}$	Sterl.
A ſpecie dollar	=	40 groſhen	=	2	0	
A rixdollar	=	5 orts	=	4	6	
A gold ducat	=	6 florins	=	9	9	

Britain exchanges with Poland conſtantly by the medium of Amſterdam and Hamburg.

III. In

Britain exchanges with Poland conſtantly by the medium of Amſterdam and Hamburg.

III. In RIGA.

Accounts are kept in rixdollars and groſhen, reckoning 90 groſhen to a dollar.

The ordinary coins are,					s.	d.	
A rixdollar,	=	15	Riga marks	=	4	6	Sterl.
A Poliſh florin	=	5	Riga ditto	=	1	6	
A Riga mark	=	6	groſhen	=	0	3	
A vording	=	$1\frac{1}{2}$	groſs	=	0	$0\frac{3}{4}$	

The exchange is made with Hamburg at ſo many rixdollars *per cent.* rixdollars.

IV. In PRUSSIA and DANTZIC.

Accounts are kept in florins groſs, and pence, reckoning, 18 pence to 1 groſs, and 30 groſhen to a florin.

The current ſpecie as follow:					s.	d.	
A rixdollar	=	3	florins	=	4	6	Sterling.
A goulden	=	30	groſhen	=	1	6	
An ort	=	18	groſhen	=	0	$10\frac{4}{5}$	
A brummer	=	$1\frac{1}{2}$	groſhen	=	0	$0\frac{7}{9}$	
A croſs dollar	=	3	florins 16 groſhen.				
A ſpecie dollar	=	3	florins 18 groſhen.				

Pruſſia exchanges with London directly on he rixdollar, the courſe from 4 to 5*s.*;---*via* Amſterdam at 40 to 48 ſtivers *per* rixdollar, or 118 to 130 rixdollars *per* 100 rixdollars of 50 ſtivers; and *via* Hamburg at 115 to 135 rixdollars *per cent.* ditto of 48 ſchillings lubs.

EXAMPLES with DANTZIC.

1. London is indebted to Dantzic in 9750 florins 25 groſhen 16 pence; how much Sterling ought London to remit, exchange at $13\frac{3}{4}$ florins *per* pound Sterling?
   Anſwer, *L.*709 : 3 : $0\frac{3}{4}$.

2. Dantzic owes to London *L.*745 : 19 : 6; for how much is London credited in the Dantzic books, exchange at $14\frac{1}{4}$ florins?
   Anſwer, 10360 florins 4 groſhen 5 pence.

3. London owes to Dantzic *L.*547 : 19*s.*; how much ought to be remitted to Hamburg, exchange at $91\frac{1}{2}$ groſhen *per* rixdollar of Hamburg, and at 34|6 Flemiſh banco *per* pound Sterling between London and Hamburg?
   Anſwer, $2363\frac{1}{3}$.

4. Dantzic

4. Dantzic owes to London 5745 florins 20 groshen 6 pence; for how many guilders may London value on Amsterdam, exchange at 94 groshen *per* guilder?

Answer, 1828 guilders 17 stivers 2 pence.

V. IN SWEDEN.

Accounts are kept in rixdollars, copper dollars, and runsticks, reckoning 32 runsticks to a copper dollar, and 6 copper dollars to a rixdollar, the par of which being 4*s.* 6*d.* Sterling. The runstick is only an imaginary piece used in their reckoning, but they have copper farthings, 2 whereof make a runstick; 3 runsticks make 1 whitton, $10\frac{2}{3}$ whittons make a copper dollar, 6 copper dollars, or 64 whittons make a rixdollar.

The copper dollar is likewise divided into 4 marks, and each of these into 8 runsticks. They have also a stiver dollar, or Swedish rixdollar, of value 2*s.* 3*d.* Sterling, divided into 32 ore, and in this specie the custom-house receives payment of all the duties outward. The duties inward must be paid in the Swedish copperplate dollar, value 4*s.* 6*d.* divided into 48 ore.——The exchange with London is generally by Hamburg or Amsterdam, and sometimes directly, in which case they reckon the copper dollar par with our shilling, but the course runs about 28 to 30 copper dollars for the pound Sterling.

EXAMPLES WITH SWEDEN.

1. Stockholm is indebted to London in 3745 dollars 4 copper dollars 18 runsticks; how much Sterling stands in the London books, exchange at 30 copper dollars *per* pound Sterling?

Answer, *L.*749 : 2 : 8.

2. London is indebted to Stockholm in *L.*740; how many marks must be remitted to Hamburg to cancel the debt, exchange at 33|6 Flemish banco *per* pound Sterling, and for how many dollars may Stockholm draw on Hamburg, the exchange being at 98 rixdollars *per* 100 dollars?

Answer, London remits $3098\frac{3}{4}$ rixdollars; and
Stockholm draws 3161 dollars 5 copper dollars.

VI. IN RUSSIA.

Accounts are kept, especially by the merchants of Archangel and Petersburg, in rubbles and copecks, and sometimes in copecks, grieveners, and rubbles. The current monies as follow:

3 copeck

3 copecks	=	1	altin.
10 copecks	=	1	grievener.
25 copecks	=	1	polpaltin.
50 copecks	=	1	poltin.
100 copecks	=	1	rubble.
2 rubbles	=	1	ducat.

The rubble is worth betwixt 4 and 5 ſhillings Sterling, and our crown piece paſſes for 120 and ſometimes 130 copecks.

The duties are all paid in good foreign money by the weight.

The exchange is made with Hamburg at an uncertain number of copecks for the rixdollar, and with Amſterdam at an uncertain number of ſtivers for the Ruſſian rubble.

VII. In TURKY

Accounts are kept in lions, dollars, and aſpers, reckoning 80 aſpers to a dollar, and by theſe two all their other coins are rated. Here they receive in payment the ſpecie of every other country by the weight, provided the gold and ſilver is good.

The current monies are as follow:

A gold checkeen or cheffin is worth 243 aſpers.
An aſper is worth $\frac{7}{18}$ of 1 penny ſterling.
A Venetian checkeen worth 280 aſpers.
A Hungarian ditto—from 240 to 250 aſpers.
A piece of eight from 100 to 110 aſpers.
German dollars from 110 to 120.

VIII. In PERSIA

They reckon 10 goz to 1 ſhabee, 2 ſhabees to 1 mamodre, 2 mamodres to 1 abaſſee, and 7 abaſſees to 1 ſequin.

The par of 1 goz is 4*d.* and the others in proportion.

IX. In ARABIA.

Their only coins are the aſper, value ſomething leſs than a penny Sterling, the dollar whoſe value runs betwixt 60 and 80 aſpers, and the ſequin of 100 aſpers or 8*s.* Sterling.

X. In BENGAL in the EAST INDIES,

12 ree make 1 ana, and 16 ana 1 rupee=2*s.* 6*d.* Sterling.

XI. In CHINA,

10 caſh make 1 canderine, 10 canderines 1 mace, and 10 mace 1 tale=6*s.* 8*d.* Sterling.—They have no coined pieces here, but pay in gold and ſilver by weight, which they denominate by talents and meaſure.

XII. IN JAPAN

They have a piece of gold, value $L.6:11:3$, another piece of about $L.2:3:9$, and ſeveral ſilver pieces of different weights. They have but one copper piece, value $3\frac{1}{2}$ Dutch guilders.

Their gold is worth 63*s.* *per* ounce, and their ſilver 5*s.* *per* ounce.

XIII. IN EGYPT.

The gold coins are, the ſultany, xeriff, and ſequin, each eſtimated from 9*s.* 4*d.* to 9*s.* 6*d.* The ſilver coins are the Spaniſh dollar, and the muden, an Ottoman piece.

Accounts are kept by the natives in aſpers and mudens, reckoning 3 of the former to 1 of the latter; and by the Chriſtians in aſpers, and dollars divided into 30 aſpers.

XIV. IN BARBARY.

They keep their accounts in dollars and aſpers, reckoning 80 aſpers to 1 dollar.

They have the ſultany, the Venetian ſequin, and the Spaniſh piſtole in gold, which riſe and fall in their value according to the times.

OBSERVATION.

When Britain exchanges on the piece of foreign money, as the French crown, Venetian ducat, &*c.* Britain ought to remit when the exchange is low, and draw when it is high, to negociate with advantage. The reaſon will be obvious, for *L.* 100 will go farther in purchaſing ducats, crowns, milreas, &*c.* when the courſe of exchange is at 40*d.* than when it is at 50*d.* and 100 crowns will go farther in paying a debt due by France to London when the exchange is at 32*d.* than when it is only at par.

EXAMPLE.

Exam. 1. London is indebted to France in 1000 crowns, for payment of which one bill of 500 crowns is purchaſed at $31\frac{1}{2}d.$ and another at 30*d.* for the remaining 500; how much Sterling was paid for the bills, and what difference *per cent.* in the purchaſe?

First

Cr.			d.	d.		d.
First, 500 exch. at $31\frac{1}{2}$	2dly,		30 :	1.5	: :	100
8) 500						1.5
2|0) 62 10 0 at 30d.					30)	150.0
3 2 6 at $1\frac{1}{2}$d.						5 per cent. diff.
65 12 6 at $31\frac{1}{2}$d.						
62 10 0 at 30d.						
L. 128 2 6 Sterling was paid.						

Note, In exchanging with the other places of Europe not mentioned, we use the medium of Amsterdam and Hamburg, which hath rendered Amsterdam despotic in the article of exchanges.

Variety XII. Arbitration of Exchanges.

INTRODUCTION.

To be quick and accurate in arbitrating exchanges, a perfect acquaintance with, and a thorough practice in all the computations in the preceding part of this treatise will be requisite; to which must be added, a knowledge of the intrinsic value of foreign monies, according to the most accurate assays which have been made for that purpose.

A knowledge of the natural causes of the rise and fall of the course of exchange between nation and nation, or between one trading city and another of the same nation, will contribute not a little to the purposes of arbitration.

That the course of exchange is the touchstone by which the state of trade can be infallibly discovered, hath been allowed not only by great statesmen and speculative politicians, but by the most skilful and sagacious practical traders; and therefore it is the business of every exchange-negociator, who would make the most of this delicate branch, to consider with attention where the balance of trade lies among the European nations, at all points of time; for by that means only he can embrace his opportunities of profit; and these almost daily betwixt some nation or other, provided he hath a credit and correspondence extensive enough for the purpose. It very rarely happens, in a comparison of the courses of exchange, among several places together, that they are found to ebb and flow in an exact equality of proportion; for as the balance of trade differs between different nations, so the course of exchange will be in favour

of ſome, and againſt others. This being the caſe, the judgment of the exchange-negociator conſiſts in vigilantly obſerving, from a proper compariſon of the courſes of exchange, where the greateſt inequality of proportion lies, that he may thereby diſcover with certainty, where he will find his account in drawing and remitting to ſome places preferably to others; for where-ever the greateſt inequality is found, it is there that negociations of this kind will be attended with the greateſt profit; and by following this inequality, and altering the channel of his correſpondence with the fluctuation of the exchanges, he will daily improve his fortune, enliven trade, by his intelligence and correſpondence open new paths of commerce, and be an inſtrument of making the place he lives in more conſpicuous, by being the centre of his exchange negociations.

SECT. I. *Simple arbitration of exchanges.*

Caſe 1. When a factor hath orders from his employer to remit a certain ſum of money to a place, provided he can do it, at a certain price of exchange mentioned, and at the ſame time to draw for his reimburſement upon ſome other place at a certain price of exchange; to find whether the advantage in performing one part of the commiſſion will be ſufficient to compenſate for the loſs that may ariſe from the other; ſo that, in caſe he finds the negociation would be to his conſtituent's loſs, he may write him for new orders, or wait till the courſe of exchange be more in his favour; obſerve the following

RULE.

Let the price of exchange aſſigned for remitting be the firſt term, the price of exchange aſſigned for drawing be the ſecond term, and the real courſe at which the remittance can be made the third term; then will the fourth proportional give the price at which the draught ought to be made, to be at par with the price of the remittance.

By comparing which with the price of bills upon that place where the draught is to be made, the factor or correſpondent will eaſily ſee, whether he ought to obey the order or not.

EXAMPLES.

Exam. 1 A factor of London receives an order to remit to Venice 1000 ducats, at 4*s.* Sterling *per* ducat, and for this purpoſe, to put himſelf in caſh by drawing on Spain at 3*s.* 2*d.* *per* piaſtre; when this order came to hand, bills for Venice were at 50*d.*; at what price muſt London draw upon Spain to compenſate the advance on the remittance to Venice by the riſe of the exchange?

d. 48

$$\begin{array}{ccccc} d. & & d. & & d. \\ 48 & : & 50 & :: & 38 \\ \hline 12 & & 25 & & 19 \\ & & 19 & & \\ \hline 12) & & 475 & & \\ \hline \end{array}$$

$39\frac{7}{12}$ *per* piastre, advance $1\frac{7}{12}$.

OBSERVATION.

Since the factor, agreeable to the course of exchange, at the time he received the order, is obliged to remit at 50*d.* which is 1*d.* advance on each ducat, he must draw $39\frac{7}{12}d.$ for his piastre, otherwise his employer would be a loser in whatever he drew below that price: but if bills on Spain had risen more in proportion than bills on Venice, for instance, to 40*d.* *per* piastre, the order could be performed with $\frac{5}{12}d.$ advantage on each piastre.

For, first, 1000 ducats at 4*s.* $= \frac{1000}{5} = L.\ 200.$
2dly, *L.* 200 $= \frac{48000}{38}d.$ in a piastre = 1263.158 piastres.

That is, the factor in London must sell 1263.158 of his constituent's piastres before he is put in cash to make the remittance of 1000 crowns; but when he finds the course of exchange hath varied since his employer's intelligence he may first find what money the purchase of a 1000 ducats will require at 50*d.*; and supposing the course with Spain had risen to 40, he can save of the money arising from the sale of his constituent's piastres about *L.* 2 : 10 : $3\frac{1}{4}d.$

Exam. 2. An order comes to Amsterdam to remit to Genoa at 82*d.* *per* pezzoe, and draw upon London at 33*s.* 4*d.* *per* pound Sterling; when the order came to hand, bills for Genoa were at 85*d.*; how must the pound Sterling be valued to compensate the loss by the remittance to Genoa?

$$82 : 33\tfrac{1}{3} :: 85$$

$$\begin{array}{r} 85 \\ 33\tfrac{1}{3} \\ \hline 2805 \\ 28\ \ 4 \\ \hline 82)\ 2833\ \ 4 \\ \hline 34\ \ 6\tfrac{5}{8} \end{array}$$

Consequently Amsterdam must sell the London bill at 34*s.* $6\frac{5}{8}$*d.* to be at par; whatever is below that, would be a loss; and whatever is above, a profit.

Exam. 3. Rome is indebted to Naples in 3000 stamped crowns; for recovering which debt, Naples gives an order to Lyons to draw upon Rome at 42 stamped crowns for 100 French crowns; and reserving $\frac{2}{3}$ for commission, to remit the proceeds to Naples, at $75\frac{1}{2}$ ducats *per* 100 crowns; when this order came to hand, bills for Naples were at $74\frac{2}{3}$; how must Lyons draw upon Rome, so as to remit to Naples the number of ducats intended by the order, and save $\frac{2}{5}$ commission?

$$75\tfrac{1}{2} : 42 :: 74\tfrac{2}{3}$$

$$\begin{array}{rr} 75\tfrac{1}{2} & 74\tfrac{2}{3} \\ 6 & 6 \\ \hline 453 & 448 \\ & 42 \\ \hline & 896 \\ & 1792\ \ \\ \hline 453) & 18816\,(41.5364 \\ & 1812\ \ \\ \hline & 696 \\ & 453 \\ \hline & 2430 \\ & 2265 \\ \hline & 1650 \\ & 1359 \\ \hline & 2910 \\ & 2718 \\ \hline & 1920 \\ & 1812 \\ \hline & (108) \end{array}$$

Hence Lyons must draw upon Rome at $41.5304 = 41\frac{17}{35}$ nearly; as will appear more intelligibly in the following process;

$$
\begin{array}{l}
42 : 100 :: 3000 \\
\quad\quad\quad\quad\quad 100 \\
\hline
6)\ 300000 \\
\hline
7)\ 50000 \\
\hline
\quad 7142.857 \text{ French crowns.} \\
\quad\quad .004 \\
\hline
\quad 28.571428\frac{2}{7}\ \textit{per cent.} \text{ commission.} \\
\hline
7114.285572 \text{ nett proceeds to be remitted.} \\
\quad\quad 75\frac{1}{2}\ \textit{per } 100. \\
\hline
\quad 35571427860 \\
\quad 49799999004 \\
\frac{1}{2}\quad 3557142786 \\
\hline
\end{array}
$$

5371.28560686 ducats to be remitted to Naples according to the order at 42 to Rome, and $75\frac{1}{2}$ to Naples; and if the amount at 41.5366 crowns to Rome, and at $74\frac{2}{3}$ ducats to Naples, be found in the same manner, the same number of ducats will come out in the process as before.

The prices of exchange from one place are always given to other two places, in order to find the price of exchange betwixt those two places proportional to the prices given, which is called *the arbitrated price of exchange*, or, *the par by arbitration.*

In this case, the 1st and 3d terms must belong to the same country, and the 2d must be of that kind of which the price is required; the term which moves the question being always the 3d, the disposition of the terms will easily be discovered, and the 4th proportional is the par by arbitration.

Examples of arbitrating the par.

Exam. 1. Suppose bills at Paris on London at 32*d. per* crown, and on Amsterdam at 54 grotes *per* crown; what must the price of exchange be betwixt London and Amsterdam, to be on a par with the exchange betwixt Paris and those places?

d. Ster.

d. Ster.		grotes.		s.
32	:	54	: :	20
4		27	•	5
		5		
	4)	135		

s. d.
33 9 Flem. Anſwer.

Exam. 2. Suppoſe bills at London on Amſterdam are at 33*s.* 9*d.* Flemiſh *per* pound Sterling and on Paris at 32*d.* *per* ecu; what muſt the price of exchange between Amſterdam and Paris be, to make it on a par with the other two?

d. Ster.		d. Flem.		d. Ster.
240	:	405	: :	32
30		4		4
	8)	162.0		

54 grotes *per* ecu, as in the firſt example.

Exam. 3. Suppoſe bills at Amſterdam on Paris are at 54 grotes *per* ecu, and on Britain at 33*s.* 9*d.* Flemiſh *per* pound Sterling; what muſt be the price of exchange betwixt Paris and London, to be on a par with the other two?

d. Flem.		s. Ster.		d. Flem.
405	:	20	: :	54
81		4		4
	81)	216		

2*s.* 8*d.* = 32*d.* Sterl. as before.

Hence if a draught for *L.*200 Sterling were remitted to Paris at 32*d.* *per* crown, it would be found to get credit there for 1500 crowns till they were remitted to Amſterdam, when Amſterdam would be debited for the ſame number of crowns at 54 grotes which would find credit there for 2025 guilders; and if theſe guilders were remitted to London at 33*s.* 9*d.* Flemiſh *per* pound Sterling, Amſterdam would be credited for a remittance of *L.*200 Sterling, which would even the account at all thoſe places, with reſpect to this negociation without loſs or profit.

OBSERVATION.

For the speculation of the ingenious merchant on the use to be made of the arbitrated par of exchange, it will not be improper to give some examples, from the London course upon such places where the profit is seldom less than what follows, *viz.*

Suppose London draws on Amsterdam at 34*s.* 10*d.* Flemish *per* pound Sterling, and on Paris at $31\frac{7}{8}$*d per* ecu, the arbitrational price between Amsterdam and Paris will be found to be $55\frac{3}{8}\frac{3}{4}$. But suppose Amsterdam advises, that the exchange for Paris is at $54\frac{3}{4}$ grotes *per* ecu, which is below the arbitrational price, the question is, what profit presents?

Draw *L.*100 Sterling on Paris at $31\frac{7}{8}$, it will debit you at Paris for 752 *cr.* 56*s.* 5*d.* and remit to Amsterdam *L.*98 : 12 : 5 at 34*s.* 10*d.* Flemish, which credits you at Amsterdam with 1030 *guil.* 11 *st.* 12 *pen.* banco; so that the profit to be made between those places on *L.*100 is *L.*1 : 7 : 7. The money received for your draught furnishes you with money to pay for your remittance, and your debit at Paris will be cleared by your credit at Amsterdam, exchange at $54\frac{3}{4}$ grotes *per* ecu: for if $54\frac{3}{4}$ grotes will pay a French crown, 1030 *guil.* 11 *st.* 12 *pen.* bank-money will pay 752 *ecus*, 56*s.* 5*d.*

But if, on the other hand, Amsterdam advises you at London that the exchange for Paris is at $56\frac{1}{4}$, which is above the arbitrated price of exchange; in this case you must alter your course of drawing, and instead of France, as before, draw on Amsterdam for *L.*100 Sterling at 34*s.* 10*d.* Flemish, which debits you at Amsterdam in 1045 guilders banco, and remit to Paris *L.*98 : 13 : 10 at $31\frac{7}{8}$, which credits you at Paris in 743 *ecus*, 6*s.* 8*d.*; so that the profit, upon this supposition, will be *L.*1 : 6 : 2 on the 100. And the money you receive for your draught furnishes you with the money to pay for your remittance as before; your debit at Amsterdam will be paid by your credit at Paris, exchange at $56\frac{1}{4}$: for if one French crown will pay $56\frac{1}{4}$ grotes at Amsterdam, 743 *ecus*, 6*s.* 8*d.* will pay 1045 bank guilders.

Hence it is evident, that whether the advised price be above or below the arbitrational price, there is always an advantage to be made by drawing and remitting; and as it very seldom happens that the advised and arbitrational price are at par, advantageous opportunities of doing it may occur every post.—In the foregoing example the difference is supposed to be only that betwixt $55\frac{3}{8}\frac{3}{4}$ and $54\frac{3}{4}$ in one case; and in the other that between $55\frac{3}{8}\frac{3}{4}$, and $56\frac{1}{4}$, which is very small; and yet, when it is considered how many times it may be reiterated in the year, without the advance of a single shilling, it yields a profit superior to most other trades in which a man can be employed.

For another instance: Let it be supposed that London exchanges on Amsterdam at 34*s.* 10*d.* Flemish, and on Hamburg at 33*s.* 5*d.* the arbitrational price will be found to be $33\frac{1}{2}\frac{4}{0}\frac{3}{1}$ betwixt Amsterdam and Hamburg.—If in this case the advised or real price of exchange be below the arbitrated par, suppose for instance at 32*s.* then draw on Hamburg for *L.*100 at 33*s.* 5*d.* which debits you there for

1253 *marks*, 2*s*. lubs, and remit to Amsterdam *L*.95 : 18 : 7 at 34*s*. 10*d*. which credits you at Amsterdam in 1002 *guil*. 10 *stiv*. bank-money: but you received *L*.100 for your draught on Hamburg, and paid only for your bill on Amsterdam *L*.95 : 18 : 7, so that you retain in your own hands a profit of *L*.4 : 1 : 5 in negociating in this manner *L*.100.

But if, on the other hand, Amsterdam advises that the exchange betwixt Hamburg and there is at $34\frac{1}{4}$, which is above the arbitrated price, then draw on Amsterdam for *L*.100 Sterling, at 34*s*. 10*d*. where you will be debited for 1045 guilders banco, and remit to Hamburg *L*.97 : 7 : 10 at 33*s*. 5*d*: where you are credited in 1220 *mar*. 7*s*. 6 *pen*. lubs; so that, without being one shilling in advance, you have *L*.2. 12*s*. 2*d*. in your pocket for half an hour's trouble in negociating L.100; for the money you receive for your draught pays that for your remittance, and your debit at Amsterdam will be evened by your credit at Hamburg, exchange at $34\frac{1}{4}$; for if one dollar of Hamburg will pay $34\frac{1}{4}$ stivers at Amsterdam, 1220 *mar*. 7*s*. 6 *pen*. lubs will clear 1045 guilders banco of Amsterdam.

From these examples it will be obvious, that an extensive credit, and a thorough knowledge in the arbitration of exchanges, makes a sufficient capital to carry on this beneficial branch; and it is pity so few apply themselves to a study which would in so ample a manner requite their labour.

SECT. II. *Compound arbitration of exchanges.*

When the price of exchange is given betwixt one country and another, betwixt that second and a third, and betwixt that third and a fourth, *&c*.; to find the arbitrated price betwixt the first and the last, observe the following

RULE.

Place the antecedents in one column, and the consequents in another, to the right of the antecedents, so as to form a numerical equation, in the algebraic way of analysis, in which the first antecedent and the last consequent, to which an antecedent is required, must always be of the same denomination or species; the first consequent must be of the same denomination with the second antecedent; the second consequent with the third antecedent, *&c*. throughout. If a fraction is annexed to any of the numbers, both the antecedent and consequent must be multiplied into the denomination of that fraction, and the proportion will still be the same. The terms being thus disposed, cancel the quantities that are the same on both sides of the equation, and abridged such quantities as are commensurable, then multiply all the antecedents into one another for a general divisor, and all the consequents for a general dividend; and the quotient will be the answer, or value of the antecedent required.

Examples

Examples of compound arbitration.

Exam. 1. Suppose London is to remit *L*.500 to Spain by the way of Holland at 35*s*. *per* pound, thence by the way of France at 58 grotes *per* crown, thence to Venice at 100 crowns *per* 60 ducats banco, and from Venice to Spain at 360 mervadies *per* ducat banco; how many piastres of 272 mervadies will it amount to in Spain, exclusive of charges?

(1.)			(2.)		
Antecedents.		Consequents.			
1 pound	=	420*d*. Flem.	1	=	210
58 grotes	=	1 crown,	29	=	1
100 crowns	=	60 ducats,	1	=	30
1 ducat	=	360 mervadies,	1	=	45
272 mervadies	=	1 piastre;	17	=	1
how many piastres for *L*.500?					5

Cancel the ciphers in 100 and 500, divide 272 and 360 by 8, and you will have for a new antecedent 34, and for a new consequent 45; divide 34 and 60 by 2, and you will have a new antecedent 17, and a new consequent 30; lastly, divide 58 and 420 by 2, and you will have the new antecedent 29, and new consequent 210; then will the whole stand abridged as in the second equation, and the operation be as follows:

```
              210
               30
             ----
             6300
               45
            -----
             315
            252
            -----
   29      283500
   17           5
  ----    -------
  493) 1417500 (2875¼ piastres.   Answer.
        986
        ----
        4315
        3944
        ----
         3710
         3451
         ----
          2590
          2465
          ----
         (125)
```

Hence upon the supposition that $42\frac{1}{4}$*d*. had been the price of the piastre at the direct course, the *L*.500 would only have been worth $2823\frac{1}{2}$ piastres; so that, by this method of negociating, there would be a gain of 52 piastres, or 2 *per cent*. without reckoning charges.

Variety XIII. Comparifon of Weights and Meafures.

AS it is of the utmoft importance for the exteufive trader, not only to be acquainted with the weights and meafures of the different countries with which he may have occafion to deal, but with their relation one to another; I have in the firft part of this work exhibited authentic tables of all the weights and meafures of thofe countries with which we deal, and their fubdivifions, as well as the weights and meafures ufed in Britain; and I fhall now infert two tables, reprefenting the conformity which the weights and meafures of the moft noted trading places of Europe have with one another, difcoverable by infpection, and then give a few examples of their comparifon, by the rule of conjunct proportion, after the manner of compound arbitration.

[*The tables follow, to be folded in.*]

Example of the comparifon of weights and meafures.

Exam. 1. If 7 aunes of Paris make 9 yards of London, 36 yards of London 49 aunes of Holland, 7 aunes of Holland 9 braces of Milan, 3 braces of Milan 2 vares of Arragon, 5 vares of Arragon 2 canes of Montpelier, 9 canes of Montpelier 10 canes of Thouloufe, and 4 canes of Thoulouse 9 aunes of Troyes in Champaigne; how many aunes of Troys will meafure 100 aunes of Paris?

Antecedents.		Confequents.
7 aunes of Paris	=	9 yards of London,
36 yards of London	=	49 aunes of Holland,
7 aunes of Holland	=	9 braces of Milan,
3 braces of Milan	=	2 vares of Arragon,
5 vares of Arragon	=	2 canes of Montpelier,
9 canes of Montpelier	=	10 canes of Thoulouse,
4 canes of Thoulouse	=	9 aunes of Troys;
how many aunes of Troys	=	100 aunes of Paris?

Both fides of the equation being abridged, the operation will ftand,

$$\frac{3\times100}{2} = 150 \text{ aunes of Paris. Anfwer.}$$

SIMPLE

TABLE I.

(To front page 200.)

A TABLE representing the conformity which the WEIGHTS of the principal Trading Cities of EUROPE have with each other, taken from that of Mynheer Samuel Ricard, late of Amsterdam, published in the year 1732, and quoted in 1747, as the most authentic of its kind, by the Sieur Jean Larue, merchant of Lyons, in his treatise dedicated to the Count de Maurepas; with the difference only of transposing one of the columns, in order to place ENGLAND or LONDON in the front, as Mynheer Ricard, has done Holland and Amsterdam for the United Provinces, and the Sieur Larue Paris, for the use of the French Nation more particularly.

☞ As the weight of Amsterdam, Paris, Bourdeaux, Bensancon, and several other places have but a very trifling difference, they are comprehended under those of Amsterdam, as those of Nuremberg are under Frankfort, and others in the same manner.

	Make	A Of England, Scotland and Ireland.	B Of Paris Amsterdam.	C Of Antwerp, or Brabant.	D Of Rouen the viscounty weight.	E Of Lyons the city weight.	F Of Rochelle.	G Of Toulouse and Up. Languedoc.	H Of Marseilles & Provence.	I Of Geneva.	K Of Hamburgh.	L Of Frankfort, &c.	M Of Leipsic, &c.	N Of Genoa.	O Of Leghorn.	P Of Milan.	Q Of Venice.	R Of Naples.	S Of Seville, Cadiz, &c.	T Of Portugal.	V Of Liege.
A 100 lb. of England, Scotland, and Ireland, London		100 —	91 8	96 8	88 —	106 —	90 9	107 11	113 —	81 7	93 5	89 7	96 1	137 4	132 11	153 11	152 —	154 10	97 —	104 13	96 5
B 100 lb. of Amsterdam, Paris, &c.		109 8	100 —	105 8	96 4	116 —	99 —	118 —	123 8	89 —	102 —	98 —	105 —	150 —	145 —	168 —	166 —	169 —	106 —	114 8	105 4
C 100 lb. of Antwerp, or Brabant		103 12	94 12	100 —	91 4	110 —	93 13	111 12	117 —	84 5	96 10	92 13	99 8	142 2	137 6	159 3	157 ⅓	160 2	108 —	108 8	99 11
D 100 lb. of Rouen, the Viscounty		113 14	104 —	109 12	100 —	120 8	102 15	122 11	128 8	99 9	106 —	102 —	109 4	156 —	150 13	174 11	172 ⅔	175 12	110 4	119 —	109 7
E 100 lb. of Lyons, the city		94 3	86 —	90 12	82 12	100 —	85 2	101 8	106 4	76 8	87 12	84 4	90 5	129 —	124 11	144 8	142 ¾	145 6	91 3	98 8	90 8
F 100 lb. of Rochelle		110 9	101 —	106 8	97 3	117 —	100 —	119 3	124 12	89 14	103 —	99 —	106 —	151 8	146 7	169 11	167 10	170 11	107 —	115 10	106 5
G 100 lb. of Toulouse, and Upper Languedoc		92 6	84 12	89 6	81 8	98 5	83 15	100 —	105 4	75 7	86 7	83 —	89 8	127 2	122 14	142 6	140 —	143 4	89 13	97 —	89 3
H 100 lb. of Marseilles and Provence		88 11	81 —	85 8	78 —	94 —	80 3	95 9	100 —	72 —	82 10	79 6	85 8	121 8	117 7	136 1	134 8	136 14	85 13	192 12	85 4
I 100 lb. of Geneva		123 —	112 6	118 8	108 —	130 5	111 6	132 9	128 4	100 —	114 10	110 2	118 —	168 9	163 —	188 13	186 8	189 14	119 2	128 8	118 4
K 100 lb. of Hamburg		107 5	98 —	103 6	94 4	113 10	97 —	115 10	121 —	87 4	100 —	89 11	102 15	147 —	142 2	164 10	162 11	165 10	103 13	112 4	103 2
L 100 lb. of Frankfort		111 11	102 —	107 8	98 3	118 5	101 —	120 6	126 —	90 12	104 —	100 —	107 1	153 —	147 14	171 6	169 5	172 6	108 2	116 13	107 6
M 100 lb. of Leipsic		104 5	95 4	100 —	91 12	110 8	94 4	112 6	117 12	84 12	92 2	93 5	100 —	142 13	138 1	160 —	158 2	161 —	101 —	109 —	100 4
N 100 lb. of Genoa		73 —	66 ⅔	70 5	64 —	77 5	66 —	78 10	82 5	59 5	68 —	65 5	70 —	100 —	96 11	112 —	110 11	112 11	70 11	76 5	70 6
O 100 lb. of Leghorn		75 8	69 —	72 12	66 6	80 —	68 5	81 6	85 4	61 6	70 6	67 10	72 8	103 8	100 —	119 —	114 8	116 9	73 —	79 —	72 10
P 100 lb. of Milan		65 3	59 8	62 12	57 4	69 —	58 14	70 3	73 8	53 —	60 1	58 5	62 8	89 4	86 4	100 —	98 12	100 8	63 —	68 2	62 10
Q 100 lb. of Venice		65 11	60 —	63 6	57 12	69 10	59 6	70 13	74 2	53 6	61 3	58 13	63 —	90 —	87 —	100 13	100 —	101 6	63 9	68 11	63 2
R 100 lb. of Naples		64 10	59 —	62 4	57 —	68 7	58 6	69 10	72 14	52 8	60 2	57 13	62 —	88 8	85 8	99 2	98 —	100 —	62 8	67 9	62 —
S 100 lb. of Seville, Cadiz, &c.		103 7	94 8	99 12	91 —	109 10	93 9	111 8	116 11	84 2	96 6	92 10	99 4	141 12	137 —	158 12	156 14	159 12	100 —	108 3	99 14
T 100 lb. of Portugal		95 4	87 8	92 —	84 4	101 8	86 10	103 4	108 —	77 14	89 4	85 12	91 13	131 14	126 13	147 —	145 4	148 —	92 12	100 —	92 —
V 100 lb. of Leige		104 —	95 —	100 3	91 7	110 3	94 —	112 —	117 5	84 8	96 14	93 —	99 12	142 8	137 12	159 9	157 11	160 10	100 9	108 12	100 —

N. B. Such is the use of this table, that by means hereof may be easily discerned at one view, the conformity which the weights of one place therein exhibited have with those of another: for example, if you would know how many pounds 100lb. weight English make at Amsterdam, look for England in the first column, and from thence pass your eye along the line till you come to the column under the title of Amsterdam at the top, and you will find that 91 lb. 8 ounces, (reckoning 16 ounces to the pound) are equal to 100lb. English; and in like manner you may find the agreement between any other weight of these places specified in the table.

TABLE II.

(To front page 200)

TABLE representing the conformity which the LONG MEASURES of the principal TRADING CITIES of EUROPE have with each other, Published in the year 1747, as the most authentic of its kind, by the Sieur Jean Larue, merchant of Lyons, in his treatise dedicated to the Count de Maurepas; with the difference only of transposing one of the columns, in order to place ENGLAND or LONDON in the front, as the Sieur Larue has done Paris, for the use of the French nation more particularly.

☞ The ells of Amsterdam, Haerlem, Leyden, the Hague, Rotter[dam], and other cities of Holland, as well as the ell of Nuremberg, [are] equal among themselves. They are also comprehended under the [ell] of Amsterdam, as that of Osnaburg is under that of France and [E]ngland, and the ell of Bern and Basil under that of Hamburg, [Fra]nkfort, and Leipsic.

Make	A Yards of England, Scotland, & Ireland.	B Ells of France and England.	C Ells of Holland and Amsterdam.	D Ells of Antwerp and Brussels.	E Ells of Hamburgh Frank. Leipsic & Cologn	F Ells of Breslau in Silesia.	G Ells of Dantzic.	H Ells of Bergue and Drontheim	I Ells of Sweden or Stockholm	K Ells of St. Gall for linen.	L Ells of St. Gall for cloth.	M Ells of Geneva.	N Canes of Marseilles and Montpelier.	O Canes of Toulouse, Albi, and Castres.	P Canes of Genoa of 9 Palmos.	Q Canes of Rome.	R Vares of Castille and Biscay.	S Vares of Cadiz and Andalusia.	T Vares of Portugal or Lisbon.	V Coved. of Portugal or Lisbon.	W Brasses of Venice.	X Brasses of Berg. Boulogn, and Mantua.	Y Brasses of Florence, Legh. and Lucca.	Z Brasses of Milan.
100 Yards of England, Scotland and Ireland,	100 —	78 —	133 1/3	131 2/3	160 —	166 3/5	150 —	146 2/3	154 —	114 2/3	149 1/3	80 —	46 2/3	50 —	40 2/3	44 —	107 —	109 1/5	81 1/3	133 1/3	136 —	104 1/3	154 3/3	171 1/3
100 Ells of France and England	128 1/4	100 —	137 1/2	166 2/3	205 1/4	213 3/4	192 4/5	188 —	195 3/4	147 —	191 1/2	102 3/5	59 4/5	64 1/5	52 1/5	56 4/5	136 7/8	140 —	104 1/3	171 —	174 4/5	179 —	199 1/5	219 1/4
100 Ells of Holland or Amsterdam	75 —	57 2/3	100 —	98 3/4	120 —	125 —	112 1/2	110 —	114 1/2	86 —	112 —	60 —	35 —	37 1/2	30 1/2	32 —	80 —	81 4/5	61 —	100 —	102 —	105 1/4	116 1/2	128 1/2
100 Ells of Antwerp and Brussels	76 —	60 —	101 1/4	100 —	121 1/2	126 3/4	114 —	111 4/5	116 —	87 —	113 4/5	60 3/5	35 4/5	38 —	30 4/5	33 3/5	81 —	84 —	61 3/5	101 1/4	103 3/5	106 3/5	118 —	130 —
100 Ells of Hamburg, Frankfort, &c.	62 1/2	48 7/8	83 1/3	82 1/3	100 —	104 1/5	92 3/5	91 3/4	95 1/2	71 2/5	91 1/3	50 —	29 1/5	31 1/4	25 4/5	27 1/2	65 4/5	68 1/5	50 4/5	83 1/3	85 —	88 1/2	97 —	107 —
100 Ells of Breslau in Silesia	60 —	46 3/5	80 —	79 —	96 —	100 —	89 4/5	88 —	91 1/2	68 3/4	89 3/5	48 —	28 —	30 —	24 4/5	26 —	64 —	65 1/5	48 4/5	80 —	81 3/5	84 4/5	93 1/5	102 4-5
100 Ells of Dantzic	66 3/4	52 —	89 —	87 3/4	96 3/4	111 1/4	100 —	98 —	102 —	76 3/4	99 3/4	53 3/5	31 1/5	33 4/5	27 1/5	29 4/5	71 1/5	72 1/2	54 1/4	89 —	90 1/4	93 3/8	103 3/4	114 1-3
100 Ells of Bergue and Drontheim	67 1/2	52 3/4	90 —	89 —	108 —	112 1/2	101 1/2	100 —	103 —	77 4/5	100 4/5	54 —	31 1/2	33 3/4	27 4/5	29 3/4	72 —	74 3/4	55 —	90 —	91 3/4	94 3/4	105 —	115 3-4
100 Ells of Sweden or Stockholm	65 3/4	51 1/4	87 1/2	86 1/2	105 —	109 1/4	97 3/4	96 1/4	100 —	75 1/4	98 —	52 1/2	30 1/2	32 3/4	26 3/4	28 3/4	70 —	71 1/2	53 1/2	87 1/2	89 1/4	92 —	102 —	112 1-3
100 Ells of St. Gall for linen	87 —	67 3/4	116 —	114 1/2	139 1/5	145 —	130 1/2	127 3/5	133 —	100 —	130 —	69 3/5	40 2/5	43 1/2	35 4/5	38 1/3	92 4/5	95 1/5	70 2/4	116 —	118 3/4	122 —	135 1/5	149 —
100 Ells of St. Gall of cloth	67 —	52 1/2	89 1/3	88 3/4	107 1/5	111 1/4	100 1/2	98 1/4	102 1/4	76 4/5	100 —	53 3/5	31 1/4	33 1/2	27 1/3	29 1/2	71 1/2	73 —	54 1/2	89 1/3	91 1/5	94 —	104 —	114 3-4
100 Ells of Geneva	124 3/4	97 1/2	166 2/3	164 3/5	200 —	208 1/3	187 1/2	183 1/4	191 —	143 1/3	130 2/3	100 —	58 1/3	62 1/2	50 4/5	55 —	133 1/2	136 2/5	101 2/5	166 2/3	170 —	172 4/5	193 1/3	214 1-5
100 Canes of Marseilles and Montpelier	214 1/2	167 1/3	286 —	282 4/5	343 1/5	357 1/2	321 3/4	314 3/5	327 1/2	246 —	320 1/2	171 3/4	100 —	107 1/4	87 1/4	94 4/5	228 4/5	234 —	174 3/4	286 —	291 3/4	301 —	333 1/5	367 1-2
100 Canes of Toulouse and Upper Languedoc	199 3/4	156 —	266 2/3	263 1/3	320 —	333 1/3	300 —	193 1/3	304 —	229 1/3	298 2/3	160 —	93 1/3	100 —	81 1/3	88 —	213 1/3	218 —	162 2/3	266 2/3	272 —	280 3/5	309 1/3	342 2-3
100 Canes of Genoa of 9 palmos	245 1/4	191 1/3	327 —	323 —	392 4/5	408 3/4	366 4/5	359 3/4	374 1/2	281 1/4	366 1/4	196 1/4	114 1/2	122 3/5	100 —	108 —	261 3/4	268 1/5	199 1/2	327 —	338 1/2	344 1/5	381 —	420 1-5
100 Canes of Rome	227 1/4	177 1/4	303 —	299 1/5	363 3/5	378 3/4	340 4/5	333 1/3	347 —	260 3/5	339 4/5	181 4/5	116 —	113 2/3	92 4/5	100 —	242 4/5	245 3/5	184 4/5	303 —	309 —	319 —	353 —	389 4-5
100 Vares of Castile and Biscay	93 3/4	73 1/5	125 —	123 2/5	150 —	156 1/4	140 2/3	137 1/2	143 1/4	107 1/2	140 —	75 —	43 3/4	46 4/5	38 1/5	41 1/4	100 —	102 1/3	76 1/4	125 —	127 1/2	131 1/2	145 3/5	159 2-3
100 Vares of Cadiz and Andalusia	91 3/4	71 3/7	122 1/4	119 —	146 3/5	152 3/5	138 —	134 1/2	139 4/5	105 —	137 —	73 1/3	42 2/3	45 —	37 1/4	40 2/3	97 2/3	100 —	74 2/3	122 1/4	125 1/4	179 —	142 —	157 —
100 Vares of Portugal or Lisbon	123 —	96 —	164 —	162 —	196 4/5	205 —	184 1/2	180 4/5	187 3/4	141 —	183 3/5	94 4/5	57 4/5	61 1/2	50 —	54 1/5	131 1/3	134 —	100 —	164 —	167 1/4	172 3/5	191 —	210 3-4
100 Covedos of Portugal or Lisbon	74 —	58 1/2	100 —	98 3/4	120 —	125 —	112 1/2	110 —	114 1/2	86 —	112 —	60 —	35 —	37 1/2	30 1/2	33 —	80 —	81 4/5	61 —	100 —	102 —	105 1/4	116 1/2	128 1-2
100 Brasses of Venice	73 1/2	57 1/3	98 —	96 3/4	117 3/5	122 1/2	104 1/4	107 3/4	112 1/4	84 1/4	109 3/4	58 3/4	34 1/3	86 3/4	29 3/4	32 1/3	78 4/5	80 1/5	59 3/4	98 —	100 —	103 1/3	114 1/5	126 —
100 Brasses of Bergamo, &c.	72 1/4	55 3/5	95 —	93 4/5	114 —	118 3/4	106 3/4	104 1/2	108 3/4	81 3/4	106 4/5	57 —	33 1/4	35 3/5	29 —	31 3/5	76 —	78 1/5	58 —	95 —	97 —	100 —	100 3/5	122 —
100 Brasses of Florence, Leghorn, &c.	65 1/5	50 —	85 1/3	84 4/4	102 3/5	106 4/5	96 2/5	94 —	98 —	73 1/2	95 3/4	51 3/5	30 —	32 —	26 1/5	28 1/5	68 4/5	70 1/3	52 1/5	95 1/2	87 1/5	95 —	100 —	109 4-5
100 Brasses of Milan	58 1/2	45 3/5	78 —	77 —	93 3/5	97 1/2	87 3/4	85 4/5	89 1/4	67 —	87 3/5	46 4/5	27 3/5	29 1/4	23 4/5	25 3/4	62 4/5	63 2/3	47 1/2	78 —	79 1/2	82 1/5	91 —	100 —

N. B. By means of this table, the reader may please to observe, that 100 ells of Paris and of England make $137\frac{1}{2}$ of Holland; and in like manner you will find how the measures of other places in the table correspond with each other. By the common rule of three or proportion, you will easily make your computations for any quantity required. But there are more concise rules, which are practised by the most expert merchants. See the examples following.

Variety XIV. INTEREST.

SIMPLE INTEREST.

Simple interest is that which is paid for the loan of any principal or sum of money lent out for some time at any rate *per cent.* agreed on betwixt the borrower and the lender, which, according to 12 *Anne, sess.* 2. *c.* 6. no person is to take for the loan of monies, *&c.* above 5*l.* for the forbearance of 100*l.* for the space of a year; and bonds, contracts, *&c.* made for money lent at a greater interest, to be void and null, and the offender to forfeit triple value.

Case 1. The principal rate and time given, to find the interest.

RULE.

Multiply the principal by the rate, and the product by the time, the last product divided by 100 quotes the answer.

EXAMPLES.

Exam. 1. What is the interest of *L.*426 : 5 : 9 for $6\frac{1}{4}$ years, at $4\frac{1}{2}$ *per cent.*?

```
      426.2875                         Or thus,
            4½                         426.2875
      ---------                            .045
     1705.1500                        ---------
      213.14375                       21314375
      ---------                      17051500
     1918.29375                      ---------
            6¼                       191829375
      ---------                             6¼
  8)11500.76250                      ---------
     1438.7203125               8)115.0976250
     ------------                  14.3872031
100)129.484828125=L.129 9 8¼    ---------------
                                129.4848281=L.129 9 8¼
```

It would have been the same thing, though all the decimal places had been saved in the operation, but three places next the point; as any thing below the common subdivisions of a pound cannot be reckoned in interest, as there is no specie small enough to be offered in payment, and the least fraction extraordinary is usury.

The rationale of this, and all the other cases of simple interest, is deduced from compound or universal proportion: for,

L. pr. year.		*L. in.*		*L. prin.*		*years.*		
100	: 1 ::	$4\frac{1}{2}$	:	42?.2875	:	$6\frac{1}{4}$	:	L.129 9 $8\frac{1}{4}$.

And the first and last method is the same; for it makes no difference to multiply by $4\frac{1}{2}$ and divide by 100, and to multiply by .045 without any division.

Discount

DISCOUNT.

Case 1. Amount, rate, and time given, to find the principal, or present worth.

RULE.

As the amount of *L*.100 at the rate and time given is to L.100, so is the given amount to the principal or present worth required.

Exam. 1. What ready money will pay a debt, due 3 years and 145 days hence, of L.3998 : 12 : 10¼, discounting interest at 3 *per cent. per annum?*

The time = 3.4
3 the interest of 100*l.* for 1 year.

Add 10.2 the interest } of 100 for the given time.
100
110.2 the amount

Then *L*.110.2 : 100 : : 3998.6427
100

110.2) 399864.270000 (3628.53239

3998.6427	amount.
3628.53239	principal.
370.11031	discount.

3306
6926
6612
3144
2204
9402
8816
5867
5510
3570
3306
2640
2204
4360
3306
10540
9918
622

Or it will be the same thing to work as follows:

3.4
03 interest for 1*l.* for 1 year.

1.102 amount of ditto for 1 year.

Then 1.102 : 1 : : 3998.6427 : 3628.53239 as before.